Научном већу Института за физику у Београду
Београд, 15. oктобар 2018.

Предмет: Молба за покретање поступка за реизбор у звање виши научни сарадник

Молим Научно веће Института за физику да у складу са Правилником о поступку и начину вредновања и квантитавном исказивању научно-истраживачких резултата истраживача покрене поступак за мој реизбор у звање виши научни сарадник.

У прилогу достављам:

- Мишљење руководиоца пројекта са предлогом чланова комисије
- Биографске податке
- Преглед научне активности
- Елементе за квалитативну оцену научног доприноса
- Елементе за квантитативну оцену научног доприноса
- Списак објављених радова и њихове копије
- Податке о цитираности
- Фотокопију решења о претходном избору у звање
- Додатке - доказе о квалитативним елементима

С поштовањем

др Димитрије Степаненко
виши научни сарадник

Научном већу Института за физику у Београду

Београд, 15. oktobar 2018. године

Предмет: Мишљење руководиоца пројекта за реизбор др Димитрија Степаненка у звање виши научни сарадник

Др Димитрије Степаненко је запослен на Институту за физику Београд и ангажован је на пројекту основних истраживања ОИ171032 "Физика наноструктурних материјала и јако корелисаних система" чији сам руководилац.

Пошто колега задовољава услове прописане Правилником о поступку и начину вредновања и квантитавном исказивању научно-истраживачких резултата истраживача, предлажем Научном већу Института за физику у Београду да покрене поступак за реизбор др Димитрија Степаненка у звање виши научни сарадник.

За састав комисије за реизбор др Димитрија Степаненка у звање виши научни срадник предлажем:

(1) др Зорана Дохчевић-Митровић, научни саветник, Институт за физику у Београду,
(2) др Антун Балаж, научни саветник, Институт за физику у Београду,
(3) др Жељко Шљиванчанин, научни саветник, Институт за нукларне науке Винча.

Београд, 15. oktobar 2018.

др Зорана Дохчевић-Митровић
научни саветник

Биографски подаци кандидата

Димитрије Степаненко је рођен 13. 7. 1974. у Врању, где је завршио основну школу и Гимназију. Током школовања у основној и средњој школи учествовао је на такмичењима из физике и освојио бројне награде. Освојио је похвалу на међународном такмичењу "First step to Nobel Prize in Physics" који је организовала Академија наука Пољске. Освојио је прву награду на државном такмичењу из физике и био је изабран у тим за међународну физичку олимпијаду 1993. на коју национални тим није отишао.

Студирао је на Физичком факултету Универзитета у Београду, где је 1998. године дипломирао на смеру Теоријска и експериментална физика, са просечном оценом током студија 9.68. Током студија радио је у Истраживачкој станици Петница.

По дипломирању одлази на постдипломске студије на Универзитет у Бостону (Boston University) где је провео две године као стипендиста универзитета (Presidential University Graduate Fellowship). Од 2001. наставља постдипломске студије на Државном Универзитету Флориде (Florida State University). Докторат из теоријске физике кондензованог стања одбранио је 2005. године. Докторат је нострификован на Универзитету у Београду, решењем бр. 06-613-7554/4-11, 30. јануара 2012. Током постдипломских студија добио је Дирак-Хелманову награду за теоријску физику 2004. године. Током студија радио је као асистент у настави и извођењу рачунских и експерименталних вежби на додипломским студијама. Радио је и као асистент на постдипломском курсу квантне механике. Сарађивао је на истраживању у Националној лабораторији за јака магнетна поља (National High Magnetic Field Laboratory). Боравио је у истраживачким групама у ИБМ истраживачком центру (IBM T. J. Watson research Center) и на Универзитету Охаја (Ohio University).

После доктората ради на Универзитету у Базелу (Universitaet Basel), Швајцарска, у групама Гвида Буркарда и Даниела Лоса. Држао је одабрана предавања и рачунске вежбе на напредним курсевима физике кондензованог стања и физике многочестичних система и учествовао је у настави на уводним курсевима физике и примењене математике. Учествовао је у истраживањима на пројектима Швајцарске националне фондације (СНФ), Европске комисије на Марија Кири пројекту MagMaNet и ФП7 пројектима MolSpinQIP и ELFOS, као и у истраживањима у области квантне информације под покровитељством агенција DOE и IARPA Сједињених Америчких Држава. Поред истраживања, на пројектима MagMaNet, MolSpinQIP и ELFOS радио је и као организатор локалне групе конзорцијума на Универзитету у Базелу. Боравио је на Институту за нанонауке Универзитета Модена и Рећио Емилија у Модени као гостујући истраживач.

Од 2013. ради на Институту за физику у групи за нове материјале и нанонауке. Водио је пројекте билатералне сарадње са Немачком и Француском и SCOPES програм сарадње Швајцарске националне фондације. Национални је представник у европској мрежи за молекуларни магнетизам у оквиру COST акције MolSpin.

Тема научног рада кандидата је контрола спинова и наелектрисања у наноструктурама. Развио је принципе коришћења спин-орбитне интеракције за контролу спинова користећи електрична поља као класичне контролне величине у квантним тачкама и молекуларним магнетима. Ради на процесирању квантне информације у молекуларним магнетима, оптичким методама контроле нуклеарних спинова у полупроводничким наноструктурама, квантном транспорту шупљина и транспорту наелектрисања у зрнастим филмовима.

Преглед научне активности

Истраживања др Димитрија Степаненка се баве квантним својствима спинова у материјалима са наноструктуром и њиховом контролом помоћу класичних поља у сврху обраде квантне информације. Међу системима који могу послужити као основа за изградњу квантних рачунара, спинови су специфични по томе што су све њихове особине инхерентно квантне и описане коначним, обично малим, бројем степени слободе.

Слободни спинови електрона су, нажалост, лош избор за носиоце квантне инфирмације пошто је њима тешко манипулисати. Зато је квантна динамика јасно видљива и управљива само код електронских спинова урођених у веће структуре. Временска скала квантне контроле мора бити довољно кратка како декохеренција не би уништила квантне особине спинова. Просторна скала контроле мора бити довољно мала да би се манипулисали појединачни спинови. Ови захтеви говоре да су најбољи носиоци квантне информације системи димензија између једног и сто нанометара. На просторним и временским скалама карактеристичним за наносистеме, брзо променљива, јака и локална електрична поља је знатно лакше произвести него одговарајућа магнетна поља. Док су дужа времена кохеренције су повезана са мањим системима, једноставност контроле фаворизује веће. Зато свака архитектура квантног рачунара мора наћи равнотежу између ова два захтева.

Кандидатова истраживања разматрају електронске спинове у квантним тачкама са карактеристичним димензијама реда величине десет до сто нанометра, мултифероичним филмовима са зрнима величине једног до сто нанометара и молекуларним магнетима са карактеристичним димензијама од десетог дела нанометра до неколико нанометара. Теме истраживања су:

(1) контрола спинова у квантним тачкама са спин-орбитном интеракцијом
(2) ефективна интеракција спинова
(3) спин-електрична интеракција у молекуларним магнетима
(4) електричне особине материјала са мултифероичним зрнима
(5) транспорт у наноструктурама са спинском текстуром
(6) квантна мерења и контрола декохеренције

(1) Контрола спинова у квантним тачкама са спин-орбитном интеракцијом

Спин-орбитна интеракција изазива декохеренцију и тиме ствара озбиљан проблем у дизајну квантних рачунара базираних на спину електрона у једноелектронским квантним тачкама. Како су спински степени слободе знатно кохерентнији од орбиталних, спрезање смањује време кохеренције спина. Кандидат је показао да, и поред смањења времена кохеренције, спин-орбитна интеракција може бити ресурс за контролу спинова. Показао је да комбиновани ефекат временски зависне контроле и спин-орбитне интеракције производи корисна квантна логичка кола.

У периоду после претходног избора у звање виши научни сарадник, кандидат је развио процедуру за контролу спинова у квантним тачкама која користи временски зависну енергију стања у празној квантној тачки која интерагује тунеловањем са суседном квантном тачком у којој лежи спински кубит. Анализа временске зависности стања система открива неинтуитиван режим описан Ландау-Зенер прелазом. У овом режиму промена орбиталног стања везаног електрона је виртуелна, и сва промена је концентрисана на спинско стање. На основу овог прелаза конструисао је процедуру којом се спин контролише електричним пољем, без локалног мењања магнетног поља и без манипулације спин-орбитном интеракцијом. Специфичност описаног поступка је могућност обављања прецизно дефинисане квантне операције без познавања јачине магнетног поља у квантним тачкама.

Тема контроле спинова коришћењем спин-орбитне интеракције је покренута у радовима кандидата који су урађени пре претходног избора у звање. У њима је показао да квантно логичко коло на спиновима у квантним тачкама под утицајем спин-орбитне интеракције зависи од облика временске зависности примењеног импулса. Кандидат је развио метод за смањење грешке у колу коришћењем временски симетричних импулса. Показао је да оваква контрола може произвести различита квантна логичка кола варирањем временске зависности симетричних импулса. Касније је показао да се овим импулсима могу применити сва кола из скупа универзалног за квантно рачунање над кубитима кодираним у парове спинова. Развио је поступак контроле за системе спинова у константном и хомогеном магнетном пољу и за системе спинова у временски константном али просторно јако нехомогеном магнетном пољу.

- *Coherent manipulation of single electron spins with Landau-Zener sweeps*
  M. Rančić and **D. Stepanenko**
  Phys. Rev. B **94**, 241301(R) (2016), M21
- *Exchange-based CNOT gates for singlet-triplet qubits with spin-orbit interaction*
  J. Klinovaja, **D. Stepanenko**, B. I. Halperin, and D. Loss
  Phys. Rev. B **86**, 085423 (2012), M21
- *Universal quantum computation through control of spin-orbit coupling*
  D. Stepanenko and N. E. Bonesteel, Physical Review Letters **93**, 140501 (2004)
- *Spin-orbit coupling and time-reversal symmetry in pulsed quantum gates*
  D. Stepanenko, N. E. Bonesteel, D. P. DiVincenzo, G. Burkard, and D. Loss
  Phys. Rev. B **68**, 115306 (2003), M21a
- *Anisotropic spin exchange in pulsed quantum gates*
  N. E. Bonesteel, **D. Stepanenko**, and D. P. DiVincenzo
  Phys. Rev. Lett. **87**, 207901 (2001), M21a

(2) Ефективна интеракција спинова

Квантни рачунари су засновани на системима са малим бројем дискретних квантних бројева. Природа коришћених квантних бројева зависи од имплементације и они не описују цео систем. Са друге стране, примена квантних логичких кола захтева хамилтонијан који је функција искључиво кубитних степени слободе. Поједностављење описа система преласком са стварних степени слободе на ефективни систем логичких кубита је користан први корак у дизајну квантних рачунара. Кандидат је развио ефективне описе за неколико типова кубита.

У периоду после претходног избора у звање виши научни сарадник, кандидат је развио ефективни хамилтонијан за троструку квантну тачку. Трострука квантна тачка је значајна као најмањи логички кубит који омогућавају универзални скуп квантних логичких кола контролисаних само изотропном интеракцијом спинова. Зато је битно пронаћи ефективну интеракцију која приказује ефекте спин-орбитног спрезања. Кандидат је израчунао и испитао особине ефективне спинске интеракције у трострукој квантној тачки произвољне геометрије. Показао је да интеракција спинова у пару тачака зависи и од особина треће. У ефективном моделу, пронашао је опсег у коме се параметри ефективне интеракцине могу контролисати.

Пре претходног избора у звање, кандидат је израчунао ефективни спински хамилтонијан двоструке квантне тачке са спин-орбитном интеракцијом у присуству нуклеарне хиперфине интеракције са језгрима и четвороструке квантне тачке која кодира два двоспинска кубита. Ефективни хамилтонијан двоструке тачке је искористио за предвиђање доприноса спин-орбитне и нуклеарне хиперфине интеракције у тунеловању између спинских стања.

Предвиђена зависност је недавно потврђена и искоришћена у експериментима у којима су измерене јачине ових интеракција. Користећи ефективни хамилтонијан четворoструке квантне тачке, кандидат је издвојио параметар који одређује моћ ефективне интеракције у примени двокубитних квантних логичких кола. Показао је да пронађени параметар зависи од особина материјала у коме су кодиране квантне тачке и од геометрије система.

- *Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin-orbit* interaction
  M. Milivojević and **D. Stepanenko**
  J. Phys. Cond. Matter **29**, 405302 (2017), M22
- *Singlet-triplet splitting in double quantum dots due to spin-orbit and hyperfine interactions*
  D. Stepanenko, M. Rudner, B. I. Halperin, and D. Loss
  Physical Review B **85**, 075416 (2012), M21
- *Quantum gates between capacitively coupled double quantum dot two-spin qubits*
  D. Stepanenko and Guido Burkard
  Phys. Rev. B **75**, 085324 (2007), M21

(3) Спин-електрична интеракција у молекуларним магнетима

На малим просторним и временским скалама, карактеристичним за квантну контролу спинова, лакше је контролисати електрична него магнетна поља. Међутим спинови не интерагују директно са електричним пољима. Кандидат је истраживао могућности индиректне контроле спинова електричним пољима.

У периоду после претходног избора у звање, кандидат је предвидео суперрадијантни квантни фазни прелаз у систему молекуларних магнета са спин-електричном интеракцијом који интерагују са електромагнетним пољем микроталасног резонатора. Предвидео је фазни прелаз између нормалне фазе карактерисане празном шупљином и суперрадијантне фазе карактерисане шупљином са ненултим бројем фотона. Пронашао је да у суперрадијантној фази компоненте електричних диполних момената молекула које леже у равни магнетних центара показују јаке флуктуације. Прелаз је специфичан зато што се критична јачина интеракције електричног поља и спинова може променити применом спољног хомогеног магнетног поља. Зато би у принципу било могуће мењати фазу система спољним константним магнетним пољем.

Спин-електрична интеракција у молекуларним магнетима је откриће кандидата из периода пре претходног избора у звање. Интеракција је недавно измерена у електронској спинској резонанци молекуларних магнета. Кандидат је предвидео да ефекат може постојати у свим антиферомагнетним молекулима без симетрије на инверзију. Претходни резултати кандидата су класификација ових интеракција у молекуларним прстеновима и предвиђање последица интеракције по електромагнетни и топлотни одзив материјала. Кандидат је идентификовао композитне спинске степене слободе молекула који интерагују са електричним пољима. Показао је да су времена кохеренције узроковане интеракцијом са језгрима код ових степени слободе два до пет редова величине дужа од одговарајућих времена кохеренције појединачних спинова и пројекције укупног спина молекула.

- *Field-dependent superradiant quantum phase transition of molecular magnets in microwave* cavities
  D. Stepanenko, M. Trif, O. Tsyaplyatyev, and D. Loss
  Semicond. Sci. Technol. **31**, 094003 (2016), M22
- *Hyperfine-induced decoherence in triangular spin-cluster qubits*
  F. Troiani, **D. Stepanenko**, and D. Loss

Phys. Rev. B **86**, 161409(R) (2012), M21

- *Spin-electric effects in molecular antiferromagnets*
  M. Trif, F. Troiani, **D. Stepanenko**, and D. Loss
  Phys. Rev. B **82**, 045429 (2010), M21
- *Quantum computing with molecular magnets*
  D. Stepanenko, M. Trif, and D. Loss, M22
  Inorg. Chim. Acta **361**, 3740 (2008)
- *Spin-electric coupling in molecular magnets*
  M. Trif, F. Troiani, **D. Stepanenko**, and D. Loss
  Phys. Rev. Lett. **101**, 217201 (2008), M21a

(4) Електричне особине зрнастих мултифероичних материјала

Спин електрична интеракција која се може користити за обраду квантне информације није једини случај преплитања електричних и магнетних својстава материје. Многи мултифероици показују истовремено електрично и магнетно уређење.

У периоду после претходног избора у звање, кандидат је проучавао електрична својства филмова који се састоје од зрна бизмут ферита. Зрнаста структура доводи делове материјала у јако електрично поље које природно постоји на границама зрна и у околини дефеката. Кандидат је проучавао промене у електричним особинама филмова бизмут ферита на путу од унутрашњости зрна, која по структури личи на унутрашњост великих кристала, до границе зрна које на њу не личи. Пронађено је да површина између два суседна зрна и њена околина у дубини до неколико нанометра проводи наелектрисање знатно боље од унутршњости зрна. Механизам проводности у овој области не одговара ниједном од стандардних модела који описују полупроводнике или метале. Пронађено је и да се ова необична област близу границе шири у јаким електричним пољима. Хистерезисни одзив проводности у функцији напона мења природу између две области.

Поред напона на границама зрна, контрола кристалографске фазе може утицати на појаву јаких унутарњих електричних поља у материјалу и промене елктричних својстава. Кандидат је посматрао промене диелектричних особина допираних мултифероика са додавањем примеса холмијума. Пронађено је да допирање мења састав матријала по кристалографским фазама и њихов диелектрични и фероелектрични одзив. У јако допираним узорцима, фероелектрични одговор опстаје до јако високих поља и доводи до значајне електричне поларизације.

- *Dielectric and ferroelectric properties of Ho-doped BiFeO3 films across the structural phase transition*
  B. Stojadinović, Z. Dohčević-Mitrović, **D. Stepanenko**, M. Rosić, I. Petronijević, N. Tasić, N. Ilić, B. Matović, B. Stojanović
  Ceram. Int. **43**, 16531 (2017) , M21a
- *Variation of electric properties across the grain boundaries in BiFeO3 films*
  B. Stojadinović, B. Vasić, **D. Stepanenko**, N. Tadić, R. Gajić, and Z. Dohčević-Mitrović
  J. Phys. D **49**, 045309 (2016), M21

(5) Транспорт у наноструктурама са спинском текстуром

Електрични транспорт у наноструктурама на ниским температурама је одређен квантном интерференцијом путева кроз структуру. У случају носилаца наелектрисања са спиновима, детељи интерференције зависе и од спинских степени слободе. Контрола кретања наелектрисања је основа електронике. Зависност транспорта наелектрисања од спина и спински транспорт су основе електронике засноване на спину - спинтронике.

У периоду пре претходног избора у звање, кандидат је проучавао интерференцију спинова у квантном транспорту. У III-V полупровидничким структурама, шупљине показују специфичан облик спин-орбитне интеракције, које је доминантно кубна по компонентама импулса, за разлику од стандардне линеарне интеракције електрона. Кандидат је показао како ова необична интеракција утиче на квантни транспорт. Резултате је генерализовао на општу дискусију Ахаронов-Бом ефекта у системима са спинским интеракцијама, уз ограничење спински независног расејања.

- *Current-conserving Aharonov-Bohm interferometry with arbitrary spin interactions*
  M. Lee and **D. Stepanenko**
  Phys. Rev. B **85**, 075316 (2012), M21
- *Interference of heavy holes in an Aharonov-Bohm ring*
  D. Stepanenko, M. Lee, G. Burkard, and D. Loss
  Phys. Rev. B **79**, 235301 (2009), M21

(6) Квантна мерења и контрола кохеренције

Квантна кохеренција је неопходан услов за функционисање квантног рачунара. Њена мера је време кохеренције, дефинисано као карактеристично време у коме стање кубита пређе из добро дефинисаног квантног стања у статистичку мешавину која не носи квантну информацију. Код кубита заснованих на спиновима у квантним тачкама кохеренција је ограничена спин-орбитном интеракцијом и хиперфином интеракцијом електронских и нуклеарних спинова.

У периоду пре претходног избора у звање, кандидат је развио поступак припреме неполарисаних стања језгара која су по утицају на губитак кохеренције спина еквивалентна поларизацијама реда 0.99. Припрема је заснована на ефекту електромагнетски индуковане транспарентности, мерењу емисије фотона и прилагођавању параметара експеримента у зависности од измерених времена емисије. У нумеричким симулацијама је показао да тако припремљена језгра изазивају спори губитак кохеренције.

- *Optical preparation of nuclear spins coupled to a localized electron spin*
  D. Stepanenko and G. Burkard
  Proc. 4th Symposium on Mesoscopic Superconductivity and Spintronics, 371 (2008), M33
- *Enhancement of electron spin coherence by optical preparation of nuclear spins*
  D. Stepanenko, G. Burkard, G. Giedke, and A. Imamoglu
  Phys. Rev. Lett. **96**, 136401 (2006), M21a

Елементи за квалитативну оцену научног доприноса

1 Квалитет научних резултата

1.1 Научни ниво и значај резлтата, утицај научних радова

Др Димитрије Степаненко је у свом досадашњем раду покренуо теме контроле спинова у квантним тачкама прилагођавањем временске зависности котролних параметара и спин-електричне интеракције у молекуларним магентима. Објавио је 18 радова у међународним часописима са ISI листе. Од тога 5 радова у часописима категорије М21а, 10 у часописима категорије М21 и 3 у часописима категорије М22. Поред радова у часописима, објавио је и једно саопштење са конференције штампано у целини које спада у категорију М33, 15 саопштења са скупова штампаних у изводу која спадају у категорију М34 и једно поглавље у монографији које спада у категорију М13.

У периоду после претходног избора у звање виши научни сарадник, кандидат је објавио један рад у часопису категорије М21а, два рада у часописима категорије М21, два рада у часописима категорије М22 и један прегледни рад у категорији М13.

Одржао је три предавања по позиву на научним скуповима.

Најзначајнији радови кандидата су:

1:
Coherent manipulation of single electron spins with Landau-Zener sweeps
Marko J. Rančić and Dimitrije Stepanenko
Phys. Rev. B **94**, 241301(R) (2016)
М21, цитиран 2 пута по Web of Science и по Google Scholar

2:
Singlet-triplet splitting in double quantum dots due to spin-orbit and hyperfine interactions
Dimitrije Stepanenko, Mark Rudner, Bertrand I. Halperin, and Daniel Loss
Phys. Rev. B **85**, 075416 (2012),
М21, цитиран 44 пута по Web of Science, 68 пута по Google Scholar

3:
Spin-Electric Coupling in Molecular Magnets
Mircea Trif, Filippo Troiani, Dimitrije Stepanenko, and Daniel Loss
Phys. Rev. Lett. **101**, 217201 (2008), М21а
М21а, цитиран 113 пута по Web of Science, 158 пута по Google Scholar

4:
Enhancement of Electron Spin Coherence by Optical Preparation of Nuclear Spins
Dimitrije Stepanenko, Guido Burkard, Geza Giedke, and Atac Imamoglu
Phys. Rev. Lett. **96**, 136401 (2006)
М21а, цитиран 111 пута по Web of Science, 169 пута по Google Scholar

5:
Universal Quantum Computation through Control of Spin-Orbit Coupling
D. Stepanenko and N. E. Bonesteel

Phys. Rev. Lett. **93**, 140501 (2004)
M21a, цитиран 55 пута по Web of Science, 78 пута по Google Scholar

Први рад представља нови облик контроле спинова помоћу временски зависних електричних поља. Кандидат је аутор идеје о контроли спинова помоћу временске зависности енергије електронских нивоа квантне тачке. Допринос кандидата укључује поставку проблема, аналитички третман прелаза у пару квантних тачака и интерпретацију нумеричких резултата. Истраживање је обављено у сарадњи са студентом постдипломских студија на Универзитету Констанц, у оквиру пројекта билатералне сарадње са Немачком. За разлику од ранијих метода који се ослањају на контролу облика напонских импулса којима се контролише електрично поље, нови облик контроле се заснива на Ландау-Зенер прелазу између својственог стања квантне тачке која носи спин и својственог стања суседне празне квантне тачке. Специфичност овог метода је да не захтева прецизно познавање параметара система за прецизну примену квантног логичког кола. Показано је да релативна неосетљивост прелаза на детаље система и спољног контролног поља чини прелаз неосетљивим на декохеренцију. Овим резултатом отворена је могућност контроле спинова у случајевима када технолошка ограничења спречавају фину контролу временске зависности контролних импулса.

У другом раду, представљен је метод којим се у укупној вероватноћи промене спина при тунеловању електрона између две квантне тачке могу раздвојити доприноси спин-орбитне и нуклеарне хиперфине интеракције. Резултати недавног експеримента потврђују облик израчунате зависности и мере однос интензитета спин-орбитне и нуклеарне хиперфине интеракције у двострукој квантној тачки. Рад је урађен у сарадњи са колегама са Универзитета у Базелу, Швајцарска и Универзитета Харвард, Сједињене Америчке Државе. Кандидат је поставио и нумерички решио модел које описује доприносе прелаза изазваних разматраним интеракцијама и њихову интерференцију. Са сарадницима је анализирао примењивост модела у различитим режимима параметара двоструке квантне тачке.

У трећем раду представљено је откриће интеракције спинова у молекуларним магнетима са електричним пољем. Кандидатов допринос се састоји од основне идеје да интеракција електричног поља са вишеспинским системима може постојати, раду са сарадницима на симетријској анализи, идентификацији спинских степени слободе значајних за интеракцију и дискусији модела заснованог на локализованим орбиталама. Ефекат је недавно потврђен у електронској спинској резонанци. На основу овог резултата и каснијих истраживања спин-електричне интеракције, покренути су пројекти MagMaNet, ELFOS, и MolSpinQIP. Кандидат наставља рад на овој теми у сарадњи са групом у CNRS Saclay, Република Француска и у оквиру COST акције CA15128-Molecular Spintronics.

У четвртом раду анализиран је стандардни експеримент квантне оптике, прозрачност индукована електромагнетним пољем, у прелазима између спинских стања и ексцитона у квантној тачки. Показано је да се мерењем тренутка емисије и прилагођавањем таласне дужине ласера у зависности од времена емисије нуклеарни спинови доводе у стање у коме слабо утичу на кохеренцију електронског спина у квантној тачки. Кандидатов допринос се састоји од постављања модела који описују мерење, његовог решавања и анализе временске зависности статистичког оператора нуклеарних спинова од резултата мерења. Овај метод је касније прилагођен на експерименте у којима се мери транспорт електрона кроз квантне тачке у режиму Кулонове блокаде.

Пети рад се баве контролом спинова у квантним тачкама коришћењем временски зависних електричних поља и спин-орбитне интеракције. Конструисан је универзални скуп квантних логичких кола за кубите кодиране у стања пара спинова на блиским квантним тачкама у полупроводнику са спин-орбитном интеракцијом. Конструисани скуп не захтева променљива магнетна поља за примену и поједностављује конструкцију квантног рачунара базираног на спину. Кандидат је у дискусији са сарадницима поставио проблем, дефинисао простор доступних операција, конструисао логичка кола и анализирао зависност грешке кола од примењених импулса. Овај резултат је један од повода за каснију сарадњу са групом на Универзитету Констанц у Савезној Републици Немачкој на развоју квантне контроле.

1.2 Позитивна цитираност научних радова кандидата

Према ISI Web of Science бази, радови кандидата су цитирани 603 пута, 579 пута без самоцитата. Кандидатов h-индекс је 11. Према бази Google Scholar, радови кандидата су цитирани 897 пута са h-индексом 12.

1.3 Параметри квалитета часописа

Кандидат је објавио пет радова у часописима категорије M21a, и то четири у Physical Review Letters, и један у Ceramics International. У часописима категорије M21 објавио је 10 радова, од тога 9 у Physical Review B, и један у Journal of Physics D: Applied Physics. У часописима категорије M22 објавио је три рада, по један у Journal of Physics: Condensed Matter, Semiconductor Science and Technology и Inorganica Chimica Acta. Кандидат је аутор поглавља Molecular Magnets for Quantum Information Processing у монографији Molecular Magnets, Physics and Applications, Springer 2014, које је класификовано у категорију M13.

После претходног избора у звање објавио је један рад категорије M21a, два рада категорије M21, два рада категорије M22, једно поглавље у монографији, класификовано као M13, и једно саопштење са међународне конференције, категорије M34, штампано у изводу.

Додатни библиометријски показатељи:

	Импакт фактор	M	Снип
Укупно	14,16	36	5,14
Усредњено по чланку	2,83	7,20	1,03
Усредњено по аутору	4,53	10,19	1,53

1.4 Степен самосталности и степен учешћа у реализацији радова у научним центрима у земљи и иностранству

Кандидат је развијао идеје, те рачунске и нумеричке методе потребне за решавање проблема у дискусијама са сарадницима. Основне идеје за разматрање проводности прстенова и спин-електричне интеракције потичу од кандидата, док су за проблеме који се баве спиновима у квантним тачкама идеје резултат дискусија са сарадницима, тако да су заједничке, са значајним доприносом кандидата. У истраживању електричних особина мултифероичних филмова, кандидат је допринео теоријским увидом у процесе који се могу одигравати у испитиваним материјалима и указивањем на интересантне детаље, док је основна идеја потекла из круга осталих сарадника.

Сви теоријски резултати имају значајан допринос кандидата, док је нумерички део посла равномерно подељен међу свим сарадницима. Око једне трећине нумеричких израчунавања су резултати кандидата, док је остатак самостални допринос осталих сарадника. У раду на проблемима спин-електричног ефекта у молекулима, поред доприноса теоријском разматрању и нумеричким израчунавањима, кандидат је организовао поделу рада међу сарадницима.

Кандидат сарађује са групама за теоријску физику кондензованог стања Универзитета у Базелу, Швајцарска, групом за квантну физику наносистема на Институту у Орсеју, Француска, групом за квантну спинтронику на Универзитету Констанц, Немачка, групом за молекуларни магнетизам на Националном центру за нанотехнологију у Модени, Италија, групом за неорганску хемију Универзитета у Валенсији, Шпанија и групом за физику квантне информације на Универзитету Цингхуа, Пекинг. Руководиоци ових група су Данијел Лос, Паскал Симон, Гвидо Буркард, Марко Афронте, Еугенио Коронадо и Мирча Триф.

1.5 Награде

- Presidential University Graduate Fellowship, Boston University. Стипендија за постдипломске студије на Уноверзитету у Бостону. Једна до две овакве награде се додељују студентима природних наука на овом универзитету.
- Dirac-Hellman award for theoretical physics. Једна награда се додељује студентима постдипломских студија или научним сарадницима на Државном Универзитету Флориде.

2 Ангажованост у формирању научних кадрова

Кандидат је ментор на мастер студијама Зорице Ристић, студенткиње Физичког факултета Универзитета у Београду. Мастер теза је одбрањена 28. 09. 2018., и студенткиња ће уписати докторске студије под менторством кандидата. Био је коментатор тезе др Симона Иерина, одбрањене на Универзитету Модене и регије Емилија у Италији. Кандидат је члан комисије која организује такмичење из физике ученика средњих школа. Сарађује са Истраживачком станицом Петница.

3 Нормирање броја коауторских радова, патената и техничких решења

Радови објављени после претходног избора у звање виши научни сарадник са темама о квантним тачкама и молекуларним магнетима су резултати до четири сарадника и садрже аналитичке и нумеричке резултате, те имају тежину 1. Радови о мултифероичним филмовима су претежно експериментални. Један од њих је приказ резултата 6 аутора, па улази са пуном тежином, 1, а други је резултат 9 аутора, па улази са тежином 0,71. Укупан ненормиран број бодова је 43,5, а нормиран 40,1, тако да је утицај нормирања мали.

4 Руковођење пројектима, потпројектима и пројектним задацима

Кандидат је руководио пројектима билатералне сарадње са Савезном Републиком Немачком (пројекат 3, 2014-15) и Републиком Француском (451-03-39/2016/09/16). Учествовао је у мрежи међународне сарадње у области молекуларне спинтронике у оквиру пројекта COST-MOLSPIN, где је заменик руководиоца радне групе за област квантне информације.

5 Активности у научним и научно-стручним друштвима

Кандидат је члан комисије за организовање такмичења из физике за ученике средњих школа. Рецензент је у часописима Nature, Nature Materials, npj Quantum Inforamtion, Nature Scientific Reports, Physical Review Letters, Physical Review B.

6 Утицајност научних резултата

Кандидатови резултати су стандардне референце за манипулацију спинова коришћењем ефекта спин-орбитне интеракције, за електричну контролу молекуларних магнета и за контролу стања нуклеарних спинова слабим квантним мерењима.

Кандидатови радови су, према бази ISI Web of Science, укупно цитирани 603 пута, од тога 579 пута не рачунајући аутоцитате, са h-индексом 11.

7 Конкретан допринос кандидата у реализацији радова у научним центрима у земљи и иностранству

Кандидат је зачетник две области у контроли спинова помоћу електричних поља. Развио је метод коришћења временске зависности електричних импулса као контролног механизма за спинове. Овај метод користи некомутирање ефективних спинских хамилтонијана узетих у различитим тренуцима током примене импулса. Метод је коришћен и за мерење интензитета интеракција које не очувавају спинове. Друга област је интеракција композитних спинских степени слободе у молекуларним магнетима са спољним електричним пољима. У овој области, резултати кандидата се користе у синтези молекуларних магнета за обраду квантне информације. Обе области развија у сарадњи са колегама у иностранству и у Србији.

8 Уводна предавања на конференцијама и друга предавања

У периоду пре претходног избора у звање, кандидат је одржао четири предавања по позиву на међународним конференцијама и радионицама:

- Molecular spins and electric fields, NORDFORSK Nanospintronics Workshop, Borgholm, Sweden, June 12.-14. 2012.
- Interaction of spins with electric fields, European Conference on Molecular Magnetism, Paris, France, November 22.-25. 2011.
- Spin-electric coupling for quantum computation and quantum optics, International conference on quantum optics and quantum computation Kiev, Ukraine, May 28. - June 1., 2010.
- Quantum transport of heavy holes through an Aharonv-Bohm ring, Spin and charge properties of low-dimensional systems, Advanced ICTP Workshop, Sibiu, Romania, June 29. - July 1., 2009.

После претходног избора у звање, кандидат је одржао предавања о својим истраживањима у групама код којих је гостовао.

- Spin-electric coupling and coherence in triangular spin clusters, University of Konstanz, 24. 11. 2014.
- Spin structure and couplings in dimers of triangular molecules, University of Valencia, 11. 12. 2017.

Елементи за квантитативну оцену научног доприноса кандидата

Остварени бодови по категоријама у периоду после претходног избора у звање:

Категорија	М бодова по раду	Број радова	Укупно М бодова (нормирано)
М21а	10	1	10 (7,1)
М21	8	2	16
М22	5	2	10
М13	7	1	7
М34	0.5	1	0.5

Поређење са минималним квантитативним условима за реизбор у звање виши научни сарадник:

Категорија	Минималан број М бодова	Остварено
Укупно	25	43,5 (40,6)
М10+М20+М31+М32+М33+М41+М42	20	43 (40,1)
М11+М12+М21+М22+М23+М24	15	36 (33.1)

Према ISI Web of Science бази, радови кандидата су цитирани 603 пута, 579 пута без аутоцитата. Према истој бази, h-фактор кандидата је 11.

Списак радова

Радови у међународним часописима изузетних вредности (M21a):

Рад објављен након претходног избора у звање:

1. *Dielectric and ferroelectric properties of Ho-doped BiFeO3 nanopowders across the structural phase transition*
   Bojan Stojadinović, Zorana Dohčević-Mitrović, Dimitrije Stepanenko, Milena Rosić, Ivan Petronijević, Nikola Tasić, Nikola Ilić, Branko Matović, and Biljana Stojanović
   Ceram. Int. **43**, 16531 (2017)

Радови објављени пре претходног избора у звање:

1. *Spin-electric coupling in molecular magnets*
   Mircea Trif, Filippo Troiani, Dimitrije Stepanenko, and Daniel Loss
   Phys. Rev. Lett. **101**, 217201 (2008)
2. *Enhancement of electron spin coherence by optical preparation of nuclear spins*
   Dimitrije Stepanenko, Guido Burkard, Geza Giedke, and Atac Imamoglu
   Phys. Rev. Lett. **96**, 136401 (2006)
3. *Universal quantum computation through control of spin-orbit coupling*,
   D. Stepanenko and N. E. Bonesteel
   Phys. Rev. Lett. **93**, 140501 (2004)
4. *Anisotropic spin exchange in pulsed quantum gates*
   N. E. Bonesteel, D. Stepanenko, and D. P. DiVincenzo
   Phys. Rev. Lett. **87**, 207901 (2001)

Радови објављени у врхунским међународним часописима (M21):

Радови објављени након претходног избора у звање:

1. *Coherent manipulation of single electron spins with Landau-Zener sweeps*
   Marko Rančić and Dimitrije Stepanenko
   Phys. Rev. B **94**, 241301(R) (2016)
2. *Variation of electric properties across the grain boundaries in $BiFeO_3$ film*
   Bojan Stojadinović, Borislav Vasić, Dimitrije Stepanenko, Nenad Tadić, Radoš Gajić and Zorana Dohčević-Mitrović
   J. Phys. D Appl. Phys. **49**, 045309 (2016)

Радови објављени пре претходног избора у звање:

1. *Hyperfine-induced decoherence in triangular spin-cluster qubits*
   Filippo Troiani, Dimitrije Stepanenko, and Daniel Loss
   Phys. Rev. B **86**, 161409(R) (2012)
2. *Exchange-based CNOT gates for singlet-triplet qubits with spin-orbit interaction*
   Jelena Klinovaja, Dimitrije Stepanenko, Bertrand I. Halperin, and Daniel Loss:, Phys. Rev. B **86**, 085423 (2012)
3. *Current-conserving Aharonov-Bohm interferometry with arbitrary spin interactions*,
   Minchul Lee and Dimitrije Stepanenko
   Phys. Rev. B **85**, 075316 (2012)

4. *Singlet-triplet splitting in double quantum dots due to spin-orbit and hyperfine interactions*
   Dimitrije Stepanenko, Mark Rudner, Bertrand I. Halperin, and Daniel Loss
   Phys. Rev. B **85**, 075416 (2012)
5. *Spin-electric effects in molecular antiferromagnets*
   Mircea Trif, Filippo Troiani, Dimitrije Stepanenko, and Daniel Loss
   Phys. Rev. B **82**, 045429 (2010)
6. *Interference of heavy holes in an Aharonov-Bohm ring*
   Dimitirje Stepanenko, Minchul Lee, Guido Burkard, and Daniel Loss
   Phys. Rev. B **79**, 235301 (2009)
7. *Quantum gates between capacitively coupled double quantum dot two-spin qubits*,
   Dimitrije Stepanenko and Guido Burkard
   Phys. Rev. B **75**, 085324 (2007)
8. *Spin-orbit coupling and time-reversal symmetry in pulsed quantum gates*
   D. Stepanenko, N. E. Bonesteel, D. P. DiVincenzo, G. Burkard, and Daniel Loss
   Phys. Rev. B **68**, 115306 (2003)

Радови објављени у истакнутим међународним часописима (М22):

Радови објављени након претходног избора у звање:

1. *Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin-orbit interaction*
   Marko Milivojević and Dimitrije Stepanenko
   J. Phys. Condens. Mat. **29**, 405302 (2017)
2. *Field-dependent superradiant quantum phase transition of molecular magnets in microwave cavities*
   Dimitrije Stepanenko, Mircea Trif, Oleksandr Tsyaplyatyev, and Daniel Loss
   Semicon. Sci. Tech. **31**, 094003 (2016)

Рад објављен пре претходног избора у звање:

1. *Quantum computing with molecular magnets*
   Dimitrije Stepanenko, Mircea Trif, and Daniel Loss
   Inorg. Chim. Acta **361**, 3740 (2008)

Поглавље у истакнутој монографији међународног значаја (М13):

1. Molecular magnets for quantum information processing, in Molecular magnets, physics and applications, ISBN 978-3-642-40608-9, Springer, 2014.
   Kevin van Hoogdalem, Dimitrije Stepanenko, and Daniel Loss

Предавање по позиву са међународног скупа, штампано у изводу (М32):

1. Spin-electric coupling in molecular magnets
   The 19th symposium on Condensed Matter Physics, Belgrade, Serbia, 2015.

Предавање по позиву са скупа националног значаја, штампано у изводу (М62):

1. Квантни рачунари базирани на квантним тачкама и спин-орбит интеракцији
   Дани физике кондензованог стања материје, Српска академија наука и уметности, Београд, Србија, 2013.

Подаци о цитираности

Према ISI Web of Science, радови кандидата су цитирани 603 пута, 579 пута без аутоцитата, уз h-индекс 11.

ИНСТИТУТ ЗА ФИЗИКУ
ПРИМЉЕНО: 04-03-2014

Рад.јед.	број		прилог
0801	226/1		

Република Србија
МИНИСТАРСТВО ПРОСВЕТЕ,
НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА
Комисија за стицање научних звања

Број:660-01-00194/254
29.01.2014. године
Б е о г р а д

На основу члана 22. става 2. члана 70. став 6. Закона о научноистраживачкој делатности ("Службени гласник Републике Србије", број 110/05 и 50/06 – исправка и 18/10), члана 2. става 1. и 2. тачке 1 – 4.(прилози) и члана 38. Правилника о поступку и начину вредновања и квантитативном исказивању научноистраживачких резултата истраживача ("Службени гласник Републике Србије", број 38/08) и захтева који је поднео

Институт за физику у Београду

Комисија за стицање научних звања на седници одржаној 29.01.2014. године, донела је

ОДЛУКУ
О СТИЦАЊУ НАУЧНОГ ЗВАЊА

Др Димитрије Степаненко

стиче научно звање
Виши научни сарадник

у области природно-математичких наука - физика

О Б Р А З Л О Ж Е Њ Е

Институт за физику у Београду

утврдио је предлог број 903/1 од 12.07.2013. године на седници научног већа Института и поднео захтев Комисији за стицање научних звања број 955/1 од 25.07.2013. године за доношење одлуке о испуњености услова за стицање научног звања ***Виши научни сарадник***.

Комисија за стицање научних звања је по претходно прибављеном позитивном мишљењу Матичног научног одбора за физику на седници одржаној 29.01.2014. године разматрала захтев и утврдила да именовани испуњава услове из члана 70. став 6. Закона о научноистраживачкој делатности ("Службени гласник Републике Србије", број 110/05 и 50/06 – исправка и 18/10), члана 2. става 1. и 2. тачке 1 – 4.(прилози) и члана 38. Правилника о поступку и начину вредновања и квантитативном исказивању научноистраживачких резултата истраживача ("Службени гласник Републике Србије", број 38/08) за стицање научног звања *Виши научни сарадник*, па је одлучила као у изреци ове одлуке.

Доношењем ове одлуке именовани стиче сва права која му на основу ње по закону припадају.

ПРЕДСЕДНИК КОМИСИЈЕ — МИНИСТАР

др Станислава Стошић-Грујичић — Проф. др Томислав Јовановић

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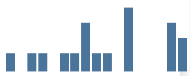

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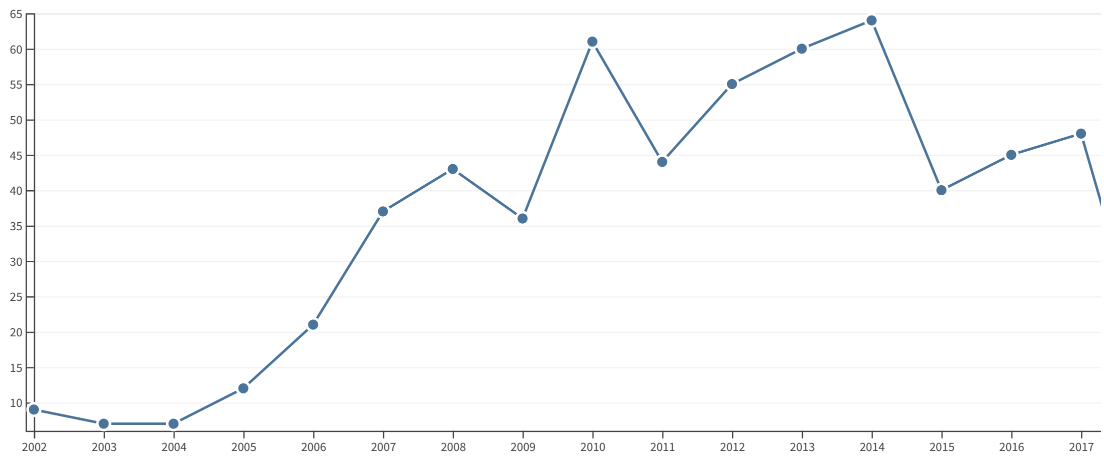

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By: Mathivathanan, L (Mathivathanan, Logesh); Boudalis, AK (Boudalis, Athanassios K.); Turek, P (Turek, Philippe); Pissas, M (Pissas, Michael); Sanakis, Y (Sanakis, Yiannis); Raptis, RG (Raptis, Raphael G.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Raptis, Raphael	D-2833-2009	0000-0002-9522-0369
Boudalis, Athanassios		0000-0002-8797-1170
Mathivathanan, Logesh		0000-0002-3666-885X

Title: Interactions between H-bonded [CuII3((3)-OH)] triangles; a combined magnetic susceptibility and EPR study

Source: PHYSICAL CHEMISTRY CHEMICAL PHYSICS

Volume: 20

Issue: 25

Pages: 17234-17244

DOI: 10.1039/c8cp02643b

Published: JUL 7 2018

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ISSN: 1463-9076

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PubMed ID: 29901059

Record 2 of 110

By: Zheng, YD (Zheng Yi-Dan); Mao, Z (Mao Zhu); Zhou, B (Zhou Bin)

Title: Thermal entanglement of Ising-Heisenberg chain with triangular plaquettes

Source: ACTA PHYSICA SINICA

Volume: 66

Issue: 23

Article Number: 230304

DOI: 10.7498/aps.66.230304

Published: DEC 5 2017

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

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Times Cited in BIOSIS Citation Index: 0

Total Times Cited: 1

ISSN: 1000-3290

Accession Number: WOS:000417504800006

Record 3 of 110

By: Ghosh, R (Ghosh, Roopayan); Maiti, M (Maiti, Moitri); Shukrinov, YM (Shukrinov, Yury M.); Sengupta, K (Sengupta, K.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Maiti, Moitri	D-3681-2015	0000-0002-1331-4725

Title: Magnetization-induced dynamics of a Josephson junction coupled to a nanomagnet

Source: PHYSICAL REVIEW B

Volume: 96

Issue: 17

Article Number: 174517

DOI: 10.1103/PhysRevB.96.174517

Published: NOV 22 2017

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Times Cited in Web of Science Core Collection: 1
Times Cited in SciELO Citation Index: 0
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Total Times Cited: 1
ISSN: 2469-9950
eISSN: 2469-9969
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Record 4 of 110
By: Rancic, MJ (Rancic, Marko J.); Burkard, G (Burkard, Guido)
Title: Ultracoherent operation of spin qubits with superexchange coupling
Source: PHYSICAL REVIEW B
Volume: 96
Issue: 20
Article Number: 201304
DOI: 10.1103/PhysRevB.96.201304
Published: NOV 7 2017
Times Cited in BIOSIS Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
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Times Cited in SciELO Citation Index: 0
Total Times Cited: 1
ISSN: 2469-9950
eISSN: 2469-9969
Accession Number: WOS:000414529300001

Record 5 of 110
By: Vignesh, KR (Vignesh, Kuduva R.); Soncini, A (Soncini, Alessandro); Langley, SK (Langley, Stuart K.); Wernsdorfer, W (Wernsdorfer, Wolfgang); Murray, KS (Murray, Keith S.); Rajaraman, G (Rajaraman, Gopalan)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wernsdorfer, Wolfgang	M-2280-2016	0000-0003-4602-5257
Kuduva Radhakrishnan, Vignesh		0000-0002-0971-2990
Soncini, Alessandro		0000-0002-6779-7304

Title: Ferrotoroidic ground state in a heterometallic {(CrDy6III)-Dy-III} complex displaying slow magnetic relaxation
Source: NATURE COMMUNICATIONS
Volume: 8
Article Number: 1023
DOI: 10.1038/s41467-017-01102-5
Published: OCT 18 2017
Times Cited in Chinese Science Citation Database: 0
Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in Web of Science Core Collection: 5
Total Times Cited: 5
ISSN: 2041-1723
Accession Number: WOS:000413169000003
PubMed ID: 29044098

Record 6 of 110
By: Milivojevic, M (Milivojevic, Marko); Stepanenko, D (Stepanenko, Dimitrije)
Title: Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin-orbit interaction
Source: JOURNAL OF PHYSICS-CONDENSED MATTER
Volume: 29
Issue: 40
Article Number: 405302
DOI: 10.1088/1361-648X/aa7f86
Published: OCT 11 2017
Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 0
Times Cited in Web of Science Core Collection: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 0
ISSN: 0953-8984
eISSN: 1361-648X
Accession Number: WOS:000425258500001
PubMed ID: 28703716

Record 7 of 110
By: Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Russ, Maximilian		0000-0001-9775-0323

Title: Three-electron spin qubits
Source: JOURNAL OF PHYSICS-CONDENSED MATTER
Volume: 29
Issue: 39
Article Number: 393001
DOI: 10.1088/1361-648X/aa761f
Published: OCT 4 2017
Times Cited in Chinese Science Citation Database: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in Web of Science Core Collection: 10
Times Cited in SciELO Citation Index: 0
Total Times Cited: 10
ISSN: 0953-8984
eISSN: 1361-648X
Accession Number: WOS:000408760400001
PubMed ID: 28562367

Record 8 of 110
By: Zhao, PZ (Zhao, P. Z.); Xu, GF (Xu, G. F.); Ding, QM (Ding, Q. M.); Sjoqvist, E (Sjoqvist, Erik); Tong, DM (Tong, D. M.)
Title: Single-shot realization of nonadiabatic holonomic quantum gates in decoherence-free subspaces
Source: PHYSICAL REVIEW A
Volume: 95
Issue: 6
Article Number: 062310
DOI: 10.1103/PhysRevA.95.062310
Published: JUN 6 2017
Times Cited in BIOSIS Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 5
Times Cited in Chinese Science Citation Database: 1
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 6
ISSN: 2469-9926
eISSN: 2469-9934
Accession Number: WOS:000402794000002

Record 9 of 110
By: Gaudenzi, R (Gaudenzi, Rocco); de Bruijckere, J (de Bruijckere, Joeri); Reta, D (Reta, Daniel); Moreira, IDPR (Moreira, Iberio de P. R.); Rovira, C (Rovira, Concepcio); Veciana, J (Veciana, Jaume); van der Zant, HSJ (van der Zant, Herre S. J.); Burzuri, E (Burzuri, Enrique)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Reta, Daniel	H-6853-2015	0000-0003-0000-9892
ROVIRA, Concepcio*	F-3155-2011	0000-0002-2365-9479
Veciana, Jaume		0000-0003-1023-9923
Gaudenzi, Rocco		0000-0002-0762-6351

Burzuri, Enrique		0000-0001-7906-7192

Title: Redox-Induced Gating of the Exchange Interactions in a Single Organic Diradical

Source: ACS NANO

Volume: 11

Issue: 6

Pages: 5879-5883

DOI: 10.1021/acsnano.7b01578

Published: JUN 2017

Times Cited in BIOSIS Citation Index: 1

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 3

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Total Times Cited: 3

ISSN: 1936-0851

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Accession Number: WOS:000404808000067

PubMed ID: 28494146

Record 10 of 110

By: Molina, V (Molina, V.); Rauhalahti, M (Rauhalahti, M.); Hurtado, J (Hurtado, J.); Fliegl, H (Fliegl, H.); Sundholm, D (Sundholm, D.); Munoz-Castro, A (Munoz-Castro, A.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Fliegl, Heike	D-7499-2014	0000-0002-7541-115X
Sundholm, Dage Matts Borje		0000-0002-2367-9277

Title: Aromaticity introduced by antiferromagnetic ligand mediated metal-metal interactions. Insights from the induced magnetic response in [Cu-6(dmPz)(6)(OH)(6)]

Source: INORGANIC CHEMISTRY FRONTIERS

Volume: 4

Issue: 6

Pages: 986-993

DOI: 10.1039/c7qi00023e

Published: JUN 1 2017

Times Cited in BIOSIS Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

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Total Times Cited: 3

ISSN: 2052-1553

Accession Number: WOS:000403440100010

Record 11 of 110

By: Ghirri, A (Ghirri, Alberto); Candini, A (Candini, Andrea); Affronte, M (Affronte, Marco)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Candini, Andrea	B-8521-2015	0000-0003-3909-473X
GHIRRI, ALBERTO		0000-0001-7316-3765

Title: Molecular Spins in the Context of Quantum Technologies

Source: MAGNETOCHEMISTRY

Volume: 3

Issue: 1

Article Number: 12

DOI: 10.3390/magnetochemistry3010012

Published: MAR 2017

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

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Times Cited in BIOSIS Citation Index: 0

Total Times Cited: 8

ISSN: 2312-7481

Accession Number: WOS:000400853200008

Record 12 of 110

By: Baldovi, JJ (Baldovi, J. J.); Cardona-Serra, S (Cardona-Serra, S.); Gaita-Arino, A (Gaita-Arino, A.); Coronado, E (Coronado, E.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coronado Miralles, Eugenio		0000-0002-1848-8791
Baldovi, Jose J.		0000-0002-2277-3974

Edited by: VanEldik, R (VanEldik, R); Cronin, L (Cronin, L)

Title: Design of Magnetic Polyoxometalates for Molecular Spintronics and as Spin Qubits

Source: ADVANCES IN INORGANIC CHEMISTRY, VOL 69: POLYOXOMETALATE CHEMISTRY

Book Series Title: Advances in Inorganic Chemistry

Volume: 69

Pages: 213-249

DOI: 10.1016/bs.adioch.2016.12.003

Published: 2017

Times Cited in BIOSIS Citation Index: 0

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Times Cited in Chinese Science Citation Database: 0

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Times Cited in Russian Science Citation Index: 0

Total Times Cited: 4

ISSN: 0898-8838

ISBN: 978-0-12-811105-5

Accession Number: WOS:000432516800009

Record 13 of 110

By: Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)

Title: Landau-Zener transitions in spin qubit encoded in three quantum dots

Source: QUANTUM INFORMATION PROCESSING

Volume: 16

Issue: 1

Article Number: UNSP 10

DOI: 10.1007/s11128-016-1480-z

Published: JAN 2017

Times Cited in BIOSIS Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

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Times Cited in Russian Science Citation Index: 0

Total Times Cited: 2

ISSN: 1570-0755

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Accession Number: WOS:000394355100010

Record 14 of 110

By: Mousolou, VA (Mousolou, Vahid Azimi); Canali, CM (Canali, C. M.); Sjoqvist, E (Sjoqvist, Erik)

Title: Spin-electric Berry phase shift in triangular molecular magnets

Source: PHYSICAL REVIEW B

Volume: 94

Issue: 23

Article Number: 235423

DOI: 10.1103/PhysRevB.94.235423

Published: DEC 20 2016

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 0

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Total Times Cited: 0

ISSN: 2469-9950

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Accession Number: WOS:000394546100004

Record 15 of 110

By: Biswas, S (Biswas, Sourav); Das, S (Das, Sourav); Gupta, T (Gupta, Tulika); Singh, SK (Singh, Saurabh Kumar); Pissas, M (Pissas, Michael); Rajaraman, G (Rajaraman, Gopalan); Chandrasekhar, V (Chandrasekhar, Vadapalli)

Title: Observation of Slow Relaxation and Single-Molecule Toroidal Behavior in a Family of Butterfly-Shaped Ln(4) Complexes

Source: CHEMISTRY-A EUROPEAN JOURNAL

Volume: 22

Issue: 51

Pages: 18532-18550

DOI: 10.1002/chem.201603640

Published: DEC 19 2016

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 6

Times Cited in SciELO Citation Index: 0

Total Times Cited: 6

ISSN: 0947-6539

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Accession Number: WOS:000390600900034

PubMed ID: 27943506

Record 16 of 110

By: Chiesa, A (Chiesa, Alessandro); Santini, P (Santini, Paolo); Carretta, S (Carretta, Stefano)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Santini, Paolo	H-7341-2017	0000-0002-1182-0173

Title: Supramolecular Complexes for Quantum Simulation

Source: MAGNETOCHEMISTRY

Volume: 2

Issue: 4

Article Number: UNSP 37

DOI: 10.3390/magnetochemistry2040037

Published: DEC 2016

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 1

Times Cited in BIOSIS Citation Index: 0

Times Cited in Russian Science Citation Index: 0

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Total Times Cited: 1

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Accession Number: WOS:000388106700001

Record 17 of 110

By: Burkard, G (Burkard, Guido); Petta, JR (Petta, J. R.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

Title: Dispersive readout of valley splittings in cavity-coupled silicon quantum dots

Source: PHYSICAL REVIEW B

Volume: 94

Issue: 19

Article Number: 195305

DOI: 10.1103/PhysRevB.94.195305

Published: NOV 14 2016

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 9

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Times Cited in SciELO Citation Index: 0

Total Times Cited: 9

ISSN: 2469-9950

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Accession Number: WOS:000387887800006

Record 18 of 110

By: Ferrando-Soria, J (Ferrando-Soria, Jesus); Magee, SA (Magee, Samantha A.); Chiesa, A (Chiesa, Alessandro); Carretta, S (Carretta, Stefano); Santini, P (Santini, Paolo); Vitorica-Yrezabal, IJ (Vitorica-Yrezabal, Inigo J.); Tuna, F (Tuna, Floriana); Whitehead, GFS (Whitehead, George F. S.); Sproules, S (Sproules, Stephen); Lancaster, KM (Lancaster, Kyle M.); Barra, AL (Barra, Anne-Laure); Timco, GA (Timco, Grigore A.); McInnes, EJL (McInnes, Eric J. L.); Winpenny, REP (Winpenny, Richard E. P.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Whitehead, George	E-6639-2017	0000-0003-1949-4250
Ferrando Soria, Jesus	P-5809-2015	
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Carretta, Stefano		0000-0002-2536-1326

Title: Switchable Interaction in Molecular Double Qubits

Source: CHEM

Volume: 1

Issue: 5

Pages: 727-752

DOI: 10.1016/j.chempr.2016.10.001

Published: NOV 10 2016

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

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Times Cited in Web of Science Core Collection: 11

Total Times Cited: 11

ISSN: 2451-9294

Accession Number: WOS:000389801400010

Record 19 of 110

By: Stepanenko, D (Stepanenko, Dimitrije); Trif, M (Trif, Mircea); Tsyplyatyev, O (Tsyplyatyev, Oleksandr); Loss, D (Loss, Daniel)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Field-dependent superradiant quantum phase transition of molecular magnets in microwave cavities

Source: SEMICONDUCTOR SCIENCE AND TECHNOLOGY

Volume: 31

Issue: 9

Article Number: 094003

DOI: 10.1088/0268-1242/31/9/094003

Published: SEP 2016

Times Cited in Chinese Science Citation Database: 0

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ISSN: 0268-1242

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Accession Number: WOS:000383973800001

Record 20 of 110

By: Belinsky, MI (Belinsky, Moisey I.)

Title: Spin Chirality of Cu-3 and V-3 Nanomagnets. 1. Rotation Behavior of Vector Chirality, Scalar Chirality, and Magnetization in the Rotating Magnetic Field, Magnetochiral Correlations
Source: INORGANIC CHEMISTRY
Volume: 55
Issue: 9
Pages: 4078-4090
DOI: 10.1021/acs.inorgchem.5b02202
Published: MAY 2 2016
Times Cited in Web of Science Core Collection: 1
Times Cited in Chinese Science Citation Database: 0
Times Cited in BIOSIS Citation Index: 0
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Times Cited in SciELO Citation Index: 0
Total Times Cited: 1
ISSN: 0020-1669
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Accession Number: WOS:000375519700004
PubMed ID: 27070665

Record 21 of 110
By: Belinsky, MI (Belinsky, Moisey I.)
Title: Spin Chirality of Cu-3 and V-3 Nanomagnets. 2. Frustration, Temperature, and Distortion Dependence of Spin Chiralities and Magnetization in the Rotating and Tilted Magnetic Fields
Source: INORGANIC CHEMISTRY
Volume: 55
Issue: 9
Pages: 4091-4109
DOI: 10.1021/acs.inorgchem.5b02204
Published: MAY 2 2016
Times Cited in Russian Science Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 0
Total Times Cited: 0
ISSN: 0020-1669
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Accession Number: WOS:000375519700005
PubMed ID: 27070817

Record 22 of 110
By: Dotti, N (Dotti, N.); Heintze, E (Heintze, E.); Slota, M (Slota, M.); Hubner, R (Huebner, R.); Wang, F (Wang, F.); Nuss, J (Nuss, J.); Dressel, M (Dressel, M.); Bogani, L (Bogani, L.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Huebner, Ralph	I-5121-2014	0000-0002-1411-6093
Dressel, Martin	D-3244-2012	0000-0003-1907-052X
Nuss, Juergen	G-2711-2010	0000-0002-0679-0184

Title: Conduction mechanism of nitronyl-nitroxide molecular magnetic compounds
Source: PHYSICAL REVIEW B
Volume: 93
Issue: 16
Article Number: 165201
DOI: 10.1103/PhysRevB.93.165201
Published: APR 4 2016
Times Cited in BIOSIS Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
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Times Cited in Russian Science Citation Index: 0
Total Times Cited: 0

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Record 23 of 110

By: Baker, ML (Baker, Michael L.); Lancaster, T (Lancaster, Tom); Chiesa, A (Chiesa, Alessandro); Amoretti, G (Amoretti, Giuseppe); Baker, PJ (Baker, Peter J.); Barker, C (Barker, Claire); Blundell, SJ (Blundell, Stephen J.); Carretta, S (Carretta, Stefano); Collison, D (Collison, David); Gudel, HU (Guedel, Hans U.); Guidi, T (Guidi, Tatiana); McInnes, EJL (McInnes, Eric J. L.); Moller, JS (Moeller, Johannes S.); Mutka, H (Mutka, Hannu); Ollivier, J (Ollivier, Jacques); Pratt, FL (Pratt, Francis L.); Santini, P (Santini, Paolo); Tuna, F (Tuna, Floriana); Tregenna-Piggott, PLW (Tregenna-Piggott, Philip L. W.); Vitorica-Yrezabal, IJ (Vitorica-Yrezabal, Inigo J.); Timco, GA (Timco, Grigore A.); Winpenny, REP (Winpenny, Richard E. P.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Baker, Peter	E-4216-2010	0000-0002-2306-2648
Baker, Michael	D-1196-2015	0000-0002-8246-3177
Guidi, Tatiana	H-6280-2011	0000-0001-9320-2960
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Chiesa, Alessandro		0000-0003-2955-3998
Carretta, Stefano		0000-0002-2536-1326
Pratt, Francis		0000-0002-5919-3885

Title: Studies of a Large Odd-Numbered Odd-Electron Metal Ring: Inelastic Neutron Scattering and Muon Spin Relaxation Spectroscopy of Cr8Mn

Source: CHEMISTRY-A EUROPEAN JOURNAL

Volume: 22

Issue: 5

Pages: 1779-1788

DOI: 10.1002/chem.201503431

Published: JAN 26 2016

Times Cited in SciELO Citation Index: 0

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Total Times Cited: 4

ISSN: 0947-6539

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Accession Number: WOS:000368924100031

PubMed ID: 26748964

Record 24 of 110

By: Duan, Y (Duan, Yan); Clemente-Juan, JM (Clemente-Juan, Juan M.); Gimenez-Saiz, C (Gimenez-Saiz, Carlos); Coronado, E (Coronado, Eugenio)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coronado, Eugenio	E-8960-2014	
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
DUAN, Yan	G-7948-2016	0000-0002-2849-5602
Gimenez-Saiz, Carlos	M-1426-2014	0000-0002-3174-0912
Coronado Miralles, Eugenio		0000-0002-1848-8791

Title: Cobalt Clusters with Cubane-Type Topologies Based on Trivacant Polyoxometalate Ligands

Source: INORGANIC CHEMISTRY

Volume: 55

Issue: 2

Pages: 925-938

DOI: 10.1021/acs.inorgchem.5b02532

Published: JAN 18 2016

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 17

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 1

Times Cited in SciELO Citation Index: 0

Total Times Cited: 17

ISSN: 0020-1669

eISSN: 1520-510X

Accession Number: WOS:000369211700063

PubMed ID: 26731303

Record 25 of 110

By: Scarrozza, M (Scarrozza, Marco); Barone, P (Barone, Paolo); Sessoli, R (Sessoli, Roberta); Picozzi, S (Picozzi, Silvia)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Picozzi, Silvia	E-2374-2011	0000-0002-3232-788X
Barone, Paolo	C-8918-2011	0000-0001-7222-8627
Sessoli, Roberta		0000-0003-3783-2700

Title: Magnetoelectric coupling and spin-induced electrical polarization in metal-organic magnetic chains

Source: JOURNAL OF MATERIALS CHEMISTRY C

Volume: 4

Issue: 19

Pages: 4176-4185

DOI: 10.1039/c5tc03613e

Published: 2016

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 3

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ISSN: 2050-7526

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Accession Number: WOS:000376041700010

Record 26 of 110

By: Chien, YL (Chien, Yu-Ling); Chang, MW (Chang, Ming-Wen); Tsai, YC (Tsai, Yuan-Che); Lee, GH (Lee, Gene-Hsian); Sheu, WS (Sheu, Wen-Shyan); Yang, EC (Yang, En-Che)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Chang, Ming-Wen		0000-0003-0730-3963

Title: New salen-type dysprosium(III) double-decker and triple-decker complexes

Source: POLYHEDRON

Volume: 102

Pages: 8-15

DOI: 10.1016/j.poly.2015.07.048

Published: DEC 14 2015

Times Cited in Chinese Science Citation Database: 1

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 0

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Total Times Cited: 11

ISSN: 0277-5387

Accession Number: WOS:000367757100002

Record 27 of 110

By: Niu, PB (Niu, Pengbin); Shi, YL (Shi, Yun-Long); Sun, Z (Sun, Zhu); Nie, YH (Nie, Yi-Hang); Luo, HG (Luo, Hong-Gang)

Title: Kondo peak splitting and Kondo dip induced by a local moment

Source: SCIENTIFIC REPORTS

Volume: 5

Article Number: 18021

DOI: 10.1038/srep18021

Published: DEC 10 2015

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 2

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 2

ISSN: 2045-2322
Accession Number: WOS:000366134200001
PubMed ID: 26658128

Record 28 of 110

By: Yang, X (Yang, Xi); Zheng, J (Zheng, Jun); Chi, F (Chi, Feng); Guo, Y (Guo, Yong)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Guo, Yong	O-4693-2014	

Title: Spin power and efficiency in an Aharnov-Bohm ring with an embedded magnetic impurity quantum dot

Source: APPLIED PHYSICS LETTERS
Volume: 106
Issue: 19
Article Number: 193107
DOI: 10.1063/1.4921118
Published: MAY 11 2015

Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 2
Times Cited in Russian Science Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in BIOSIS Citation Index: 0
Total Times Cited: 2

ISSN: 0003-6951
eISSN: 1077-3118
Accession Number: WOS:000355008100036

Record 29 of 110

By: Palii, AV (Palii, A. V.); Clemente-Juan, JM (Clemente-Juan, J. M.); Coronado, E (Coronado, E.); Tsukerblat, B (Tsukerblat, B.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coronado, Eugenio	E-8960-2014	
icmol, icmol	I-5784-2015	
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
Coronado Miralles, Eugenio		0000-0002-1848-8791

Title: Electric Field Control of Spin-Dependent Dissipative Electron Transfer Dynamics in Mixed-Valence Molecules

Source: JOURNAL OF PHYSICAL CHEMISTRY C
Volume: 119
Issue: 14
Pages: 7911-7921
DOI: 10.1021/jp512102n
Published: APR 9 2015

Times Cited in Web of Science Core Collection: 2
Times Cited in BIOSIS Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 2

ISSN: 1932-7447
Accession Number: WOS:000352823300041

Record 30 of 110

By: Spielberg, ET (Spielberg, Eike T.); Gilb, A (Gilb, Aksana); Plaul, D (Plaul, Daniel); Geibig, D (Geibig, Daniel); Hornig, D (Hornig, David); Schuch, D (Schuch, Dirk); Buchholz, A (Buchholz, Axel); Ardavan, A (Ardavan, Arzhang); Plass, W (Plass, Winfried)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Spielberg, Eike	D-9890-2015	0000-0002-3333-5814

Title: A Spin-Frustrated Trinuclear Copper Complex Based on Triaminoguanidine with an Energetically Well-Separated Degenerate Ground State

Source: INORGANIC CHEMISTRY
Volume: 54
Issue: 7

Pages: 3432-3438

DOI: 10.1021/ic503095t

Published: APR 6 2015

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 16

Times Cited in BIOSIS Citation Index: 0

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Total Times Cited: 16

ISSN: 0020-1669

eISSN: 1520-510X

Accession Number: WOS:000352518600044

PubMed ID: 25798820

Record 31 of 110

By: Ponomaryov, AN (Ponomaryov, A. N.); Kim, N (kim, N.); Jang, ZH (Jang, Z. H.); van Tol, J (van Tol, J.); Koo, HJ (Koo, H-J); Law, JM (Law, J. M.); Suh, BJ (Suh, B. J.); Yoon, S (Yoon, S.); Choi, KY (Choi, K. Y.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
van Tol, Johan	G-4190-2011	0000-0001-6972-2149
Choi, Kwang-Yong		0000-0001-8213-5395

Title: Spin decoherence processes in the S=1/2 scalene triangular cluster (Cu-3(OH))

Source: NEW JOURNAL OF PHYSICS

Volume: 17

Article Number: 033042

DOI: 10.1088/1367-2630/17/3/033042

Published: MAR 27 2015

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 1

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Times Cited in Russian Science Citation Index: 0

Total Times Cited: 1

ISSN: 1367-2630

Accession Number: WOS:000352903000007

Record 32 of 110

By: Ghirri, A (Ghirri, Alberto); van Tol, J (van Tol, Johan); Vitorica-Yrezabal, I (Vitorica-Yrezabal, Inigo); Timco, GA (Timco, Grigore A.); Winpenny, REP (Winpenny, Richard E. P.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
van Tol, Johan	G-4190-2011	0000-0001-6972-2149
GHIRRI, ALBERTO		0000-0001-7316-3765

Title: Effects of the Dzyaloshinskii-Moriya interaction in Cr-3 triangular spin clusters detected by specific heat and multi-frequency electron spin resonance

Source: DALTON TRANSACTIONS

Volume: 44

Issue: 31

Pages: 14027-14033

DOI: 10.1039/c5dt01938a

Published: 2015

Times Cited in BIOSIS Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 4

Total Times Cited: 4

ISSN: 1477-9226

eISSN: 1477-9234

Accession Number: WOS:000359089100028

PubMed ID: 26165805

Record 33 of 110

By: Ghirri, A (Ghirri, Alberto); Troiani, F (Troiani, Filippo); Affronte, M (Affronte, Marco)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Affronte, Marco	P-2504-2016	0000-0001-5711-7822

Edited by: Gao, S (Gao, S)

Title: Quantum Computation with Molecular Nanomagnets: Achievements, Challenges, and New Trends

Source: MOLECULAR NANOMAGNETS AND RELATED PHENOMENA

Book Series Title: Structure and Bonding

Volume: 164

Pages: 383-430

DOI: 10.1007/430_2014_145

Published: 2015

Times Cited in Web of Science Core Collection: 3

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 3

ISSN: 0081-5993

ISBN: 978-3-662-45723-8; 978-3-662-45722-1

Accession Number: WOS:000370245000009

Book DOI: 10.1007/978-3-662-45723-8

Record 34 of 110

By: Frost, JM (Frost, Jamie M.); Stirling, RJ (Stirling, Robert J.); Sanz, S (Sanz, Sergio); Vyas, N (Vyas, Nidhi); Nichol, GS (Nichol, Gary S.); Rajaraman, G (Rajaraman, Gopalan); Brechin, EK (Brechin, Euan K.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nichol, Gary	K-2067-2016	0000-0002-1597-3679
Frost, Jamie	C-4574-2014	0000-0002-1836-7201
Sanz Calvo, Sergio	L-5819-2016	0000-0002-4790-4184
Brechin, Euan		0000-0002-9365-370X

Title: Turning a "useless" ligand into a "useful" ligand: a magneto-structural study of an unusual family of Cu-II wheels derived from functionalised phenolic oximes

Source: DALTON TRANSACTIONS

Volume: 44

Issue: 22

Pages: 10177-10187

DOI: 10.1039/c5dt00884k

Published: 2015

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 2

Times Cited in BIOSIS Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 2

ISSN: 1477-9226

eISSN: 1477-9234

Accession Number: WOS:000355557800009

PubMed ID: 25856756

Record 35 of 110

By: Chiesa, A (Chiesa, Alessandro); Whitehead, GFS (Whitehead, George F. S.); Carretta, S (Carretta, Stefano); Carthy, L (Carthy, Laura); Timco, GA (Timco, Grigore A.); Teat, SJ (Teat, Simon J.); Amoretti, G (Amoretti, Giuseppe); Pavarini, E (Pavarini, Eva); Winpenny, REP (Winpenny, Richard E. P.); Santini, P (Santini, Paolo)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Pavarini, Eva	F-3156-2011	0000-0003-0860-8558

Whitehead, George	E-6639-2017	0000-0003-1949-4250
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Chiesa, Alessandro		0000-0003-2955-3998
Carretta, Stefano		0000-0002-2536-1326

Title: Molecular nanomagnets with switchable coupling for quantum simulation

Source: SCIENTIFIC REPORTS

Volume: 4

Article Number: 7423

DOI: 10.1038/srep07423

Published: DEC 11 2014

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 19

Times Cited in BIOSIS Citation Index: 1

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 19

ISSN: 2045-2322

Accession Number: WOS:000346288300001

PubMed ID: 25502419

Record 36 of 110

By: Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)

Title: Readout and dynamics of a qubit built on three quantum dots

Source: PHYSICAL REVIEW B

Volume: 90

Issue: 16

Article Number: 165427

DOI: 10.1103/PhysRevB.90.165427

Published: OCT 21 2014

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 7

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 7

ISSN: 2469-9950

eISSN: 2469-9969

Accession Number: WOS:000344022800007

Record 37 of 110

By: Gysler, M (Gysler, Maren); Schlegel, C (Schlegel, Christoph); Mitra, T (Mitra, Tamoghna); Muller, A (Mueller, Achim); Krebs, B (Krebs, Bernt); van Slageren, J (van Slageren, Joris)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Mitra, Tamoghna	L-7358-2017	0000-0002-1649-6667
Muller, Achim		0000-0003-0117-4021

Title: Spin-forbidden transitions in the molecular nanomagnet V-15

Source: PHYSICAL REVIEW B

Volume: 90

Issue: 14

Article Number: 144405

DOI: 10.1103/PhysRevB.90.144405

Published: OCT 3 2014

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 4

Times Cited in BIOSIS Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 4

ISSN: 1098-0121

eISSN: 1550-235X

Accession Number: WOS:000344012900002

Record 38 of 110

By: Palii, A (Palii, Andrew); Clemente-Juan, JM (Clemente-Juan, Juan M.); Tsukerblat, B (Tsukerblat, Boris); Coronado, E (Coronado, Eugenio)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
icmol, icmol	I-5784-2015	
Coronado, Eugenio	E-8960-2014	
Coronado Miralles, Eugenio		0000-0002-1848-8791

Title: Electric field control of the optical properties in magnetic mixed-valence molecules

Source: CHEMICAL SCIENCE

Volume: 5

Issue: 9

Pages: 3598-3602

DOI: 10.1039/c4sc01056f

Published: SEP 2014

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 9

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 9

ISSN: 2041-6520

eISSN: 2041-6539

Accession Number: WOS:000340695800033

Record 39 of 110

By: Baldovi, JJ (Baldovi, Jose J.); Coronado, E (Coronado, Eugenio); Gaita-Arino, A (Gaita-Arino, Alejandro); Gamer, C (Gamer, Christoph); Gimenez-Marques, M (Gimenez-Marques, Monica); Espallargas, GM (Minguez Espallargas, Guillermo)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
icmol, icmol	I-5784-2015	
Minguez Espallargas, Guillermo	D-3164-2013	0000-0001-7855-1003
Coronado, Eugenio	E-8960-2014	
Gimenez-Marques, Monica	G-6757-2012	0000-0002-4931-5711
Baldovi, Jose J.		0000-0002-2277-3974
Coronado Miralles, Eugenio		0000-0002-1848-8791

Title: A SIM-MOF: Three-Dimensional Organisation of Single-Ion Magnets with Anion-Exchange Capabilities

Source: CHEMISTRY-A EUROPEAN JOURNAL

Volume: 20

Issue: 34

Special Issue: SI

Pages: 10695-10702

DOI: 10.1002/chem.201402255

Published: AUG 18 2014

Times Cited in Chinese Science Citation Database: 2

Times Cited in BIOSIS Citation Index: 2

Times Cited in Web of Science Core Collection: 55

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 55

ISSN: 0947-6539

eISSN: 1521-3765

Accession Number: WOS:000340505500018

PubMed ID: 24804629

Record 40 of 110

By: van Hoogdalem, KA (van Hoogdalem, Kevin A.); Albert, M (Albert, Mathias); Simon, P (Simon, Pascal); Loss, D (Loss, Daniel)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Proposal for a Quantum Magnetic RC Circuit
Source: PHYSICAL REVIEW LETTERS
Volume: 113
Issue: 3
Article Number: 037201
DOI: 10.1103/PhysRevLett.113.037201
Published: JUL 14 2014
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in Web of Science Core Collection: 3
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 3
ISSN: 0031-9007
eISSN: 1079-7114
Accession Number: WOS:000344180500008
PubMed ID: 25083661

Record 41 of 110
By: Li, JQ (Li Ji-Qiang); Zhou, B (Zhou Bin)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zhou, Bin	B-8300-2008	0000-0002-4808-0439

Title: Global entanglement in ground state of {Cu-3} single-molecular magnet with magnetic field
Source: CHINESE PHYSICS B
Volume: 23
Issue: 7
Article Number: 070302
DOI: 10.1088/1674-1056/23/7/070302
Published: JUL 2014
Times Cited in Chinese Science Citation Database: 1
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 1
Total Times Cited: 1
ISSN: 1674-1056
eISSN: 1741-4199
Accession Number: WOS:000338925300010

Record 42 of 110
By: Nossa, JF (Nossa, J. F.); Canali, CM (Canali, C. M.)
Title: Cotunneling signatures of spin-electric coupling in frustrated triangular molecular magnets
Source: PHYSICAL REVIEW B
Volume: 89
Issue: 23
Article Number: 235435
DOI: 10.1103/PhysRevB.89.235435
Published: JUN 30 2014
Times Cited in BIOSIS Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 3
Total Times Cited: 3
ISSN: 1098-0121
eISSN: 1550-235X
Accession Number: WOS:000339049700004

Record 43 of 110
By: Belinsky, MI (Belinsky, Moisey I.)

Title: Field-dependent spin chirality and frustration in V-3 and Cu-3 nanomagnets in transverse magnetic field. 1. Correlations between variable planar spin configurations, vector and scalar chiralities and magnetization

Source: CHEMICAL PHYSICS

Volume: 435

Pages: 62-94

DOI: 10.1016/j.chemphys.2013.11.012

Published: MAY 19 2014

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 3

Times Cited in BIOSIS Citation Index: 0

Total Times Cited: 3

ISSN: 0301-0104

eISSN: 1873-4421

Accession Number: WOS:000334758200009

Record 44 of 110

By: Belinsky, MI (Belinsky, Moisey I.)

Title: Field- dependent spin chirality and frustration in V-3 and Cu-3 nanomagnets in transverse magnetic field. 2. Spin configurations, chirality and intermediate spin magnetization in distorted trimers

Source: CHEMICAL PHYSICS

Volume: 435

Pages: 95-125

DOI: 10.1016/j.chemphys.2013.10.009

Published: MAY 19 2014

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

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Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 3

Total Times Cited: 3

ISSN: 0301-0104

eISSN: 1873-4421

Accession Number: WOS:000334758200010

Record 45 of 110

By: de Graaf, SE (de Graaf, S. E.); Davidovikj, D (Davidovikj, D.); Adamyan, A (Adamyan, A.); Kubatkin, SE (Kubatkin, S. E.); Danilov, AV (Danilov, A. V.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kubatkin, Sergey	O-6092-2014	0000-0001-8551-9247
Adamyan, Astghik		0000-0001-6014-8830
Danilov, Andrey		0000-0001-7838-8613

Title: Galvanically split superconducting microwave resonators for introducing internal voltage bias

Source: APPLIED PHYSICS LETTERS

Volume: 104

Issue: 5

Article Number: 052601

DOI: 10.1063/1.4863681

Published: FEB 3 2014

Times Cited in Web of Science Core Collection: 10

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 3

Total Times Cited: 10

ISSN: 0003-6951

eISSN: 1077-3118

Accession Number: WOS:000331644100083

Record 46 of 110

By: Mousolou, VA (Mousolou, Vahid Azimi); Canali, CM (Canali, Carlo M.); Sjoqvist, E (Sjoqvist, Erik)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Sjoqvist, Erik		0000-0002-4669-1818

Title: Universal non-adiabatic holonomic gates in quantum dots and single-molecule magnets

Source: NEW JOURNAL OF PHYSICS

Volume: 16

Article Number: 013029

DOI: 10.1088/1367-2630/16/1/013029

Published: JAN 17 2014

Times Cited in Chinese Science Citation Database: 1

Times Cited in BIOSIS Citation Index: 2

Times Cited in Web of Science Core Collection: 21

Times Cited in Russian Science Citation Index: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 21

ISSN: 1367-2630

Accession Number: WOS:000330623600006

Record 47 of 110

By: Hooper, TN (Hooper, Thomas N.); Inglis, R (Inglis, Ross); Palacios, MA (Palacios, Maria A.); Nichol, GS (Nichol, Gary S.); Pitak, MB (Pitak, Mateusz B.); Coles, SJ (Coles, Simon J.); Lorusso, G (Lorusso, Giulia); Evangelisti, M (Evangelisti, Marco); Brechin, EK (Brechin, Euan K.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lorusso, Giulia	L-9211-2013	0000-0002-4078-6808
Coles, Simon	A-1795-2009	0000-0001-8414-9272
Evangelisti, Marco	B-5878-2011	0000-0002-8028-9064
Pitak, Mateusz	D-1230-2010	0000-0002-3680-7100
Brechin, Euan	M-5130-2014	0000-0002-9365-370X
Nichol, Gary	K-2067-2016	0000-0002-1597-3679
Palacios Lopez, Maria Angeles	K-3903-2016	0000-0002-4879-8539
Hooper, Tom		0000-0001-7768-0938

Title: CO2 as a reaction ingredient for the construction of metal cages: a carbonate-panelled [Gd6Cu3] tridiminished icosahedron

Source: CHEMICAL COMMUNICATIONS

Volume: 50

Issue: 26

Pages: 3498-3500

DOI: 10.1039/c4cc00141a

Published: 2014

Times Cited in Web of Science Core Collection: 25

Times Cited in Chinese Science Citation Database: 1

Times Cited in Russian Science Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 0

Total Times Cited: 25

ISSN: 1359-7345

eISSN: 1364-548X

Accession Number: WOS:000332453600026

PubMed ID: 24557013

Record 48 of 110

By: Lutz, P (Lutz, Philipp); Marx, R (Marx, Raphael); Dengler, D (Dengler, Dominik); Kromer, A (Kromer, Alexander); van Slageren, J (van Slageren, Joris)

Title: Quantum coherence in a triangular Cu-3 complex

Source: MOLECULAR PHYSICS

Volume: 111

Issue: 18-19

Special Issue: SI

Pages: 2897-2902

DOI: 10.1080/00268976.2013.826421

Published: OCT 1 2013

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 1

Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 9
Times Cited in SciELO Citation Index: 0
Total Times Cited: 9
ISSN: 0026-8976
eISSN: 1362-3028
Accession Number: WOS:000325389800024

Record 49 of 110
By: Li, JQ (Li Ji-Qiang); Cheng, Z (Cheng Zhi); Zhou, B (Zhou Bin)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zhou, Bin	B-8300-2008	0000-0002-4808-0439

Title: Thermal entanglement in a {Cu-3} single molecular magnet in the magnetic field
Source: ACTA PHYSICA SINICA
Volume: 62
Issue: 19
Article Number: 190302
DOI: 10.7498/aps.62.190302
Published: OCT 2013
Times Cited in Web of Science Core Collection: 2
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 3
Total Times Cited: 3
ISSN: 1000-3290
Accession Number: WOS:000327007700004

Record 50 of 110
By: Tserkovnyak, Y (Tserkovnyak, Yaroslav)
Title: SPINTRONICS An insulator-based transistor
Source: NATURE NANOTECHNOLOGY
Volume: 8
Issue: 10
Pages: 706-707
DOI: 10.1038/nnano.2013.203
Published: OCT 2013
Times Cited in BIOSIS Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 7
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Total Times Cited: 7
ISSN: 1748-3387
Accession Number: WOS:000325345900010
PubMed ID: 24091453

Record 51 of 110

By: Carretta, S (Carretta, S.); Chiesa, A (Chiesa, A.); Troiani, F (Troiani, F.); Gerace, D (Gerace, D.); Amoretti, G (Amoretti, G.); Santini, P (Santini, P.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Gerace, Dario	L-4405-2013	
Troiani, Filippo	B-4787-2011	
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Chiesa, Alessandro		0000-0003-2955-3998
Carretta, Stefano		0000-0002-2536-1326
GERACE, Dario		0000-0002-7442-125X

Title: Quantum Information Processing with Hybrid Spin-Photon Qubit Encoding

Source: PHYSICAL REVIEW LETTERS

Volume: 111

Issue: 11

Article Number: 110501

DOI: 10.1103/PhysRevLett.111.110501

Published: SEP 10 2013

Times Cited in Chinese Science Citation Database: 1

Times Cited in Web of Science Core Collection: 17

Times Cited in BIOSIS Citation Index: 2

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 18

ISSN: 0031-9007

Accession Number: WOS:000324233400001

PubMed ID: 24074061

Record 52 of 110

By: Hurley, A (Hurley, Aaron); Baadji, N (Baadji, Nadjib); Sanvito, S (Sanvito, Stefano)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Sanvito, Stefano		0000-0002-1203-0077
Sanvito, Stefano		0000-0002-0291-715X

Title: Strategy for detection of electrostatic spin-crossover effect in magnetic molecules

Source: PHYSICAL REVIEW B

Volume: 88

Issue: 5

Article Number: 054409

DOI: 10.1103/PhysRevB.88.054409

Published: AUG 12 2013

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 0

ISSN: 1098-0121

Accession Number: WOS:000323031900004

Record 53 of 110

By: Taylor, JM (Taylor, J. M.); Srinivasa, V (Srinivasa, V.); Medford, J (Medford, J.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Taylor, Jacob	B-7826-2011	0000-0003-0493-5594

Title: Electrically Protected Resonant Exchange Qubits in Triple Quantum Dots

Source: PHYSICAL REVIEW LETTERS

Volume: 111

Issue: 5
Article Number: 050502
DOI: 10.1103/PhysRevLett.111.050502
Published: JUL 31 2013
Times Cited in Web of Science Core Collection: 49
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 1
Times Cited in Russian Science Citation Index: 0
Times Cited in BIOSIS Citation Index: 1
Total Times Cited: 49
ISSN: 0031-9007
Accession Number: WOS:000322728500003
PubMed ID: 23952376

Record 54 of 110
By: van Hoogdalem, KA (van Hoogdalem, Kevin A.); Loss, D (Loss, Daniel)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Ultrafast magnon transistor at room temperature
Source: PHYSICAL REVIEW B
Volume: 88
Issue: 2
Article Number: 024420
DOI: 10.1103/PhysRevB.88.024420
Published: JUL 19 2013
Times Cited in Web of Science Core Collection: 5
Times Cited in Chinese Science Citation Database: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Total Times Cited: 5
ISSN: 1098-0121
Accession Number: WOS:000322083500005

Record 55 of 110
By: Nath, R (Nath, R.); Tsirlin, AA (Tsirlin, A. A.); Khuntia, P (Khuntia, P.); Janson, O (Janson, O.); Forster, T (Foerster, T.); Padmanabhan, M (Padmanabhan, M.); Li, J (Li, J.); Skourski, Y (Skourski, Yu.); Baenitz, M (Baenitz, M.); Rosner, H (Rosner, H.); Rousochatzakis, I (Rousochatzakis, I.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Janson, Oleg	D-8502-2011	0000-0001-7328-5690
Rousochatzakis, Ioannis	A-5787-2009	0000-0002-5517-8389
Tsirlin, Alexander	D-6648-2013	0000-0001-6916-8256
Baenitz, Michael	E-4085-2016	
Forster, Tobias	G-7341-2011	
Nath, Ramesh	C-9345-2011	
Khuntia, Panchanan	E-4270-2010	0000-0002-4054-485X

Title: Magnetization and spin dynamics of the spin S=1/2 hourglass nanomagnet Cu-5(OH)(2)(NIPA)(4)center dot 10H(2)O
Source: PHYSICAL REVIEW B
Volume: 87
Issue: 21
Article Number: 214417
DOI: 10.1103/PhysRevB.87.214417
Published: JUN 14 2013
Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 1
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 8
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 8
ISSN: 1098-0121

Accession Number: WOS:000320389600001

Record 56 of 110

By: Florez, JM (Florez, J. M.); Vargas, P (Vargas, P.); Garcia, C (Garcia, C.); Ross, CA (Ross, C. A.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Garcia, Carlos	A-1862-2010	0000-0002-4578-5396
vargas, patricio		0000-0001-9235-9747

Title: Magnetic entropy change plateau in a geometrically frustrated layered system: FeCrAs-like iron-pnictide structure as a magnetocaloric prototype

Source: JOURNAL OF PHYSICS-CONDENSED MATTER

Volume: 25

Issue: 22

Article Number: 226004

DOI: 10.1088/0953-8984/25/22/226004

Published: JUN 5 2013

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 6

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Total Times Cited: 6

ISSN: 0953-8984

eISSN: 1361-648X

Accession Number: WOS:000319262200018

PubMed ID: 23673475

Record 57 of 110

By: Furrer, A (Furrer, Albert); Waldmann, O (Waldmann, Oliver)

Title: Magnetic cluster excitations

Source: REVIEWS OF MODERN PHYSICS

Volume: 85

Issue: 1

Pages: 367-420

DOI: 10.1103/RevModPhys.85.367

Published: MAR 5 2013

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 59

Times Cited in BIOSIS Citation Index: 1

Times Cited in Chinese Science Citation Database: 0

Total Times Cited: 59

ISSN: 0034-6861

eISSN: 1539-0756

Accession Number: WOS:000315901800001

Record 58 of 110

By: Hao, X (Hao, Xiang); Wang, XQ (Wang, Xiaoqun); Liu, C (Liu, Chen); Zhu, SQ (Zhu, Shiqun)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
wang, xiaoqun	G-8865-2011	

Title: Finite-temperature decoherence of spin states in a {Cu-3} single molecular magnet

Source: JOURNAL OF PHYSICS B-ATOMIC MOLECULAR AND OPTICAL PHYSICS

Volume: 46

Issue: 2

Article Number: 025502

DOI: 10.1088/0953-4075/46/2/025502

Published: JAN 28 2013

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 6

Times Cited in Chinese Science Citation Database: 1

Times Cited in Russian Science Citation Index: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 6

ISSN: 0953-4075

Accession Number: WOS:000313569900014

Record 59 of 110

By: George, RE (George, Richard E.); Edwards, JP (Edwards, James P.); Ardavan, A (Ardavan, Arzhang)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Edwards, James		0000-0001-6545-1193

Title: Coherent Spin Control by Electrical Manipulation of the Magnetic Anisotropy

Source: PHYSICAL REVIEW LETTERS

Volume: 110

Issue: 2

Article Number: 027601

DOI: 10.1103/PhysRevLett.110.027601

Published: JAN 7 2013

Times Cited in BIOSIS Citation Index: 3

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 25

Total Times Cited: 25

ISSN: 0031-9007

Accession Number: WOS:000313162700012

PubMed ID: 23383938

Record 60 of 110

By: Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Edited by: Langer, JS (Langer, JS)

Title: Prospects for Spin-Based Quantum Computing in Quantum Dots

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 4

Book Series Title: Annual Review of Condensed Matter Physics

Volume: 4

Pages: 51-81

DOI: 10.1146/annurev-conmatphys-030212-184248

Published: 2013

Times Cited in BIOSIS Citation Index: 2

Times Cited in SciELO Citation Index: 1

Times Cited in Web of Science Core Collection: 119

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 3

Total Times Cited: 120

ISSN: 1947-5454

ISBN: 978-0-8243-5004-8

Accession Number: WOS:000321694300004

Record 61 of 110

By: Baker, ML (Baker, Michael L.); Guidi, T (Guidi, Tatiana); Carretta, S (Carretta, Stefano); Ollivier, J (Ollivier, Jacques); Mutka, H (Mutka, Hannu); Gudel, HU (Guedel, Hans U.); Timco, GA (Timco, Grigore A.); McInnes, EJL (McInnes, Eric J. L.); Amoretti, G (Amoretti, Giuseppe); Winpenny, REP (Winpenny, Richard E. P.); Santini, P (Santini, Paolo)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Baker, Michael	D-1196-2015	0000-0002-8246-3177
Guidi, Tatiana	H-6280-2011	0000-0001-9320-2960
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Carretta, Stefano		0000-0002-2536-1326

Title: Spin dynamics of molecular nanomagnets unravelled at atomic scale by four-dimensional inelastic neutron scattering

Source: NATURE PHYSICS

Volume: 8

Issue: 12

Pages: 906-911

DOI: 10.1038/NPHYS2431

Published: DEC 2012

Times Cited in Web of Science Core Collection: 59

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 1

Times Cited in BIOSIS Citation Index: 3

Total Times Cited: 59

ISSN: 1745-2473

eISSN: 1745-2481

Accession Number: WOS:000311888200020

Record 62 of 110

By: Ungur, L (Ungur, Liviu); Langley, SK (Langley, Stuart K.); Hooper, TN (Hooper, Thomas N.); Moubaraki, B (Moubaraki, Boujemaa); Brechin, EK (Brechin, Euan K.); Murray, KS (Murray, Keith S.); Chibotaru, LF (Chibotaru, Liviu F.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ungur, Liviu	G-2057-2012	0000-0001-5015-4225
Brechin, Euan	M-5130-2014	0000-0002-9365-370X
Langley, Stuart	G-4973-2011	0000-0002-2241-1551
Murray, Keith	B-9518-2014	
Chibotaru, Liviu		0000-0003-1556-0812
Hooper, Tom		0000-0001-7768-0938

Title: Net Toroidal Magnetic Moment in the Ground State of a {Dy-6}-Triethanolamine Ring

Source: JOURNAL OF THE AMERICAN CHEMICAL SOCIETY

Volume: 134

Issue: 45

Pages: 18554-18557

DOI: 10.1021/ja309211d

Published: NOV 14 2012

Times Cited in Russian Science Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 71

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 6

Total Times Cited: 72

ISSN: 0002-7863

Accession Number: WOS:000311192100020

PubMed ID: 23110698

Record 63 of 110

By: Troiani, F (Troiani, Filippo); Stepanenko, D (Stepanenko, Dimitrije); Loss, D (Loss, Daniel)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Hyperfine-induced decoherence in triangular spin-cluster qubits

Source: PHYSICAL REVIEW B

Volume: 86

Issue: 16

Article Number: 161409

DOI: 10.1103/PhysRevB.86.161409

Published: OCT 17 2012

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 21

Times Cited in BIOSIS Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 21
ISSN: 1098-0121
Accession Number: WOS:000309903500004

Record 64 of 110
By: Troiani, F (Troiani, F.); Siloi, I (Siloi, I.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	

Title: Energy as a witness of multipartite entanglement in chains of arbitrary spins
Source: PHYSICAL REVIEW A
Volume: 86
Issue: 3
Article Number: 032330
DOI: 10.1103/PhysRevA.86.032330
Published: SEP 21 2012
Times Cited in BIOSIS Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 13
Times Cited in SciELO Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 13
ISSN: 1050-2947
Accession Number: WOS:000309101100004

Record 65 of 110
By: Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)
Title: Entanglement in a three spin system controlled by electric and magnetic fields
Source: JOURNAL OF PHYSICS-CONDENSED MATTER
Volume: 24
Issue: 37
Article Number: 375303
DOI: 10.1088/0953-8984/24/37/375303
Published: SEP 19 2012
Times Cited in Chinese Science Citation Database: 2
Times Cited in BIOSIS Citation Index: 1
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 11
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 11
ISSN: 0953-8984
eISSN: 1361-648X
Accession Number: WOS:000308202700013
PubMed ID: 22913964

Record 66 of 110
By: Bosch-Serrano, C (Bosch-Serrano, Cristian); Clemente-Juan, JM (Clemente-Juan, Juan M.); Coronado, E (Coronado, Eugenio); Gaita-Arino, A (Gaita-Arino, Alejandro); Palii, A (Palii, Andrew); Tsukerblat, B (Tsukerblat, Boris)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
Coronado, Eugenio	E-8960-2014	
Gaita-Arino, Alejandro	D-2110-2014	
icmol, icmol	I-5784-2015	
Bosch, Cristian		0000-0002-2962-4226
Coronado Miralles, Eugenio		0000-0002-1848-8791

Title: Electric Field Control of the Spin State in Mixed-Valence Magnetic Molecules
Source: CHEMPHYSCHEM
Volume: 13

Issue: 11

Pages: 2662-2665

DOI: 10.1002/cphc.201200383

Published: AUG 6 2012

Times Cited in BIOSIS Citation Index: 1

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 15

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 15

ISSN: 1439-4235

Accession Number: WOS:000306900700009

PubMed ID: 22689507

Record 67 of 110

By: Bosch-Serrano, C (Bosch-Serrano, Cristian); Clemente-Juan, JM (Clemente-Juan, Juan M.); Coronado, E (Coronado, Eugenio); Gaita-Arino, A (Gaita-Arino, Alejandro); Palii, A (Palii, Andrew); Tsukerblat, B (Tsukerblat, Boris)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coronado, Eugenio	E-8960-2014	
icmol, icmol	I-5784-2015	
Gaita-Arino, Alejandro	D-2110-2014	
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
Coronado Miralles, Eugenio		0000-0002-1848-8791
Bosch, Cristian		0000-0002-2962-4226

Title: Molecular analog of multiferroics: Electric and magnetic field effects in many-electron mixed-valence dimers

Source: PHYSICAL REVIEW B

Volume: 86

Issue: 2

Article Number: 024432

DOI: 10.1103/PhysRevB.86.024432

Published: JUL 25 2012

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 16

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Total Times Cited: 16

ISSN: 1098-0121

Accession Number: WOS:000306743100003

Record 68 of 110

By: Sameera, WMC (Sameera, W. M. C.); Pinero, DM (Pinero, Dalice M.); Herchel, R (Herchel, Radovan); Sanakis, Y (Sanakis, Yiannis); McGrady, JE (McGrady, John E.); Raptis, RG (Raptis, Raphael G.); Zueva, EM (Zueva, Ekaterina M.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Herchel, Radovan	B-4339-2008	0000-0001-8262-4666
Sameera, W. M. C.	A-6565-2013	
Sameera, W. M. C.	Q-6252-2016	0000-0003-0213-0688
Raptis, Raphael	D-2833-2009	0000-0002-9522-0369

Title: A Combined Experimental and Computational Study of the Magnetic Superexchange within a Triangular (mu 3-O)-Pyrazolato-FeIII3 Complex

Source: EUROPEAN JOURNAL OF INORGANIC CHEMISTRY

Issue: 21

Pages: 3500-3506

DOI: 10.1002/ejic.201200206

Published: JUL 2012

Times Cited in BIOSIS Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 5

Times Cited in SciELO Citation Index: 0

Total Times Cited: 5

ISSN: 1434-1948

Accession Number: WOS:000306315300018

Record 69 of 110

By: Niu, PB (Niu, Peng-Bin); Yao, H (Yao, Hui); Li, ZJ (Li, Zhi-Jian); Nie, YH (Nie, Yi-Hang)

Title: Inelastic low-temperature transport through a quantum dot with a Mn ion

Source: JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS

Volume: 324

Issue: 14

Pages: 2324-2329

DOI: 10.1016/j.jmmm.2012.02.124

Published: JUL 2012

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 3

Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 1

Times Cited in Chinese Science Citation Database: 1

Total Times Cited: 3

ISSN: 0304-8853

Accession Number: WOS:000302143900024

Record 70 of 110

By: Klimov, AV (Klimov, A. V.); Berdinskii, VL (Berdinskii, V. L.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Berdinskii, Vitalij L'vovich	E-9053-2015	0000-0001-7977-4268

Title: Magnetic of trinuclear nickel complexes-building blocks of single-molecule agpropemrtiesnets

Source: RUSSIAN JOURNAL OF INORGANIC CHEMISTRY

Volume: 57

Issue: 3

Pages: 411-415

DOI: 10.1134/S0036023612030126

Published: MAR 2012

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 0

ISSN: 0036-0236

Accession Number: WOS:000302260900017

Record 71 of 110

By: Nossa, JF (Nossa, J. F.); Islam, MF (Islam, M. F.); Canali, CM (Canali, C. M.); Pederson, MR (Pederson, M. R.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Islam, Md		0000-0003-1847-0863

Title: First-principles studies of spin-orbit and Dzyaloshinskii-Moriya interactions in the {Cu-3} single-molecule magnet

Source: PHYSICAL REVIEW B

Volume: 85

Issue: 8

Article Number: 085427

DOI: 10.1103/PhysRevB.85.085427

Published: FEB 22 2012

Times Cited in Chinese Science Citation Database: 1

Times Cited in Web of Science Core Collection: 17

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 1

Times Cited in SciELO Citation Index: 0

Total Times Cited: 17

ISSN: 1098-0121

Accession Number: WOS:000300566900008

Record 72 of 110

By: Trifunovic, L (Trifunovic, Luka); Dial, O (Dial, Oliver); Trif, M (Trif, Mircea); Wootton, JR (Wootton, James R.); Abebe, R (Abebe, Rediet); Yacoby, A (Yacoby, Amir); Loss, D (Loss, Daniel)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Long-Distance Spin-Spin Coupling via Floating Gates

Source: PHYSICAL REVIEW X

Volume: 2

Issue: 1

Article Number: 011006

DOI: 10.1103/PhysRevX.2.011006

Published: JAN 26 2012

Times Cited in BIOSIS Citation Index: 8

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 59

Total Times Cited: 59

ISSN: 2160-3308

Accession Number: WOS:000310510100001

Record 73 of 110

By: van Slageren, J (van Slageren, J.)

Edited by: Drescher, M (Drescher, M); Jeschke, G (Jeschke, G)

Title: New Directions in Electron Paramagnetic Resonance Spectroscopy on Molecular Nanomagnets

Source: EPR SPECTROSCOPY: APPLICATIONS IN CHEMISTRY AND BIOLOGY

Book Series Title: Topics in Current Chemistry-Series

Volume: 321

Pages: 199-234

DOI: 10.1007/128_2011_303

Published: 2012

Times Cited in BIOSIS Citation Index: 3

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 25

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Total Times Cited: 25

ISSN: 0340-1022

ISBN: 978-3-642-28347-5; 978-3-642-28346-8

Accession Number: WOS:000321620600008

PubMed ID: 22076082

Book DOI: 10.1007/978-3-642-28347-5

Record 74 of 110

By: Clemente-Juan, JM (Clemente-Juan, Juan M.); Coronado, E (Coronado, Eugenio); Gaita-Arino, A (Gaita-Arino, Alejandro)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
icmol, icmol	I-5784-2015	
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
Coronado, Eugenio	E-8960-2014	
Gaita-Arino, Alejandro	D-2110-2014	
Coronado Miralles, Eugenio		0000-0002-1848-8791

Title: Magnetic polyoxometalates: from molecular magnetism to molecular spintronics and quantum computing

Source: CHEMICAL SOCIETY REVIEWS

Volume: 41

Issue: 22

Pages: 7464-7478

DOI: 10.1039/c2cs35205b

Published: 2012

Times Cited in Chinese Science Citation Database: 4

Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 10

Times Cited in Web of Science Core Collection: 344

Times Cited in Russian Science Citation Index: 1

Total Times Cited: 347

ISSN: 0306-0012

eISSN: 1460-4744

Accession Number: WOS:000310068300008

PubMed ID: 22948854

Record 75 of 110

By: Maksymenko, M (Maksymenko, M.); Derzhko, O (Derzhko, O.); Richter, J (Richter, J.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Richter, Johannes	A-6339-2009	

Title: Localized states on triangular traps and low-temperature properties of the antiferromagnetic Heisenberg and repulsive Hubbard models

Source: EUROPEAN PHYSICAL JOURNAL B

Volume: 84

Issue: 3

Pages: 397-408

DOI: 10.1140/epjb/e2011-20706-8

Published: DEC 2011

Times Cited in Web of Science Core Collection: 13

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 13

ISSN: 1434-6028

eISSN: 1434-6036

Accession Number: WOS:000298009200008

Record 76 of 110

By: Santini, P (Santini, P.); Carretta, S (Carretta, S.); Troiani, F (Troiani, F.); Amoretti, G (Amoretti, G.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Carretta, Stefano		0000-0002-2536-1326

Title: Molecular Nanomagnets as Quantum Simulators

Source: PHYSICAL REVIEW LETTERS

Volume: 107

Issue: 23

Article Number: 230502

DOI: 10.1103/PhysRevLett.107.230502

Published: NOV 30 2011

Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 5

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 43

Total Times Cited: 43

ISSN: 0031-9007

Accession Number: WOS:000297501900003

PubMed ID: 22182075

Record 77 of 110

By: Belinsky, MI (Belinsky, Moisey I.)
Title: Electric polarization, toroidal moment, spin canting, and chirality induced by Dzialoshinsky-Moriya interactions in a V-3 cluster analog of multiferroics
Source: PHYSICAL REVIEW B
Volume: 84
Issue: 6
Article Number: 064425
DOI: 10.1103/PhysRevB.84.064425
Published: AUG 24 2011
Times Cited in BIOSIS Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 9
Times Cited in Russian Science Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 9
ISSN: 1098-0121
eISSN: 1550-235X
Accession Number: WOS:000294226000008

Record 78 of 110
By: Kostyrko, T (Kostyrko, Tomasz); Bulka, BR (Bulka, Bogdan R.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kostyrko, Tomasz		0000-0001-7849-0060

Title: Canonical perturbation theory for inhomogeneous systems of interacting fermions
Source: PHYSICAL REVIEW B
Volume: 84
Issue: 3
Article Number: 035123
DOI: 10.1103/PhysRevB.84.035123
Published: JUL 26 2011
Times Cited in Chinese Science Citation Database: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 8
Total Times Cited: 8
ISSN: 1098-0121
eISSN: 1550-235X
Accession Number: WOS:000293129200003

Record 79 of 110
By: Fan, T (Fan, Thomas); Tsifrinovich, VI (Tsifrinovich, Vladimir I.)
Title: Measuring the state of a single-molecule magnet with a microstrip resonator
Source: PHYSICAL REVIEW B
Volume: 84
Issue: 2
Article Number: 024410
DOI: 10.1103/PhysRevB.84.024410
Published: JUL 7 2011
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Web of Science Core Collection: 1
Total Times Cited: 1
ISSN: 1098-0121
Accession Number: WOS:000292510800007

Record 80 of 110
By: Gimenez-Lopez, MD (Gimenez-Lopez, Maria del Carmen); Moro, F (Moro, Fabrizio); La Torre, A (La Torre, Alessandro); Gomez-Garcia, CJ (Gomez-Garcia, Carlos J.); Brown, PD (Brown, Paul D.); van Slageren, J (van Slageren, Joris); Khlobystov, AN (Khlobystov, Andrei N.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Gimenez-Lopez, Maria del Carmen	A-8481-2012	0000-0003-4644-2528
Moro, Fabrizio	I-8072-2015	0000-0002-6381-0479
Gomez Garcia, Carlos Jose	A-5626-2009	0000-0002-0015-577X
icmol, icmol	I-5784-2015	
Khlobystov, Andrei	C-1240-2015	0000-0001-7738-4098
Brown, Paul		0000-0002-1911-5225
La Torre, Alessandro		0000-0002-0849-6296

Title: Encapsulation of single-molecule magnets in carbon nanotubes

Source: NATURE COMMUNICATIONS

Volume: 2

Article Number: 407

DOI: 10.1038/ncomms1415

Published: JUL 2011

Times Cited in Chinese Science Citation Database: 1

Times Cited in Web of Science Core Collection: 57

Times Cited in SciELO Citation Index: 0

Times Cited in BIOSIS Citation Index: 4

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 57

ISSN: 2041-1723

Accession Number: WOS:000294805300034

PubMed ID: 21792186

Record 81 of 110

By: Bellucci, S (Bellucci, S.); Onorato, P (Onorato, P.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bellucci, Stefano	C-9235-2011	
Bellucci, Stefano		0000-0003-0326-6368
Onorato, Pasquale		0000-0002-2110-7582

Title: Quantum nanojunctions as spintronic logic operators: Gate response in a two input ballistic interferometer

Source: JOURNAL OF APPLIED PHYSICS

Volume: 109

Issue: 12

Article Number: 123715

DOI: 10.1063/1.3598127

Published: JUN 15 2011

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 0

ISSN: 0021-8979

Accession Number: WOS:000292331200064

Record 82 of 110

By: Maksymenko, M (Maksymenko, M.); Derzhko, O (Derzhko, O.); Richter, J (Richter, J.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Richter, Johannes	A-6339-2009	

Title: Low-Temperature Properties of the Quantum Heisenberg Antiferromagnet on Some One-Dimensional Lattices Containing Equilateral Triangles

Source: ACTA PHYSICA POLONICA A

Volume: 119

Issue: 6

Pages: 860-862

DOI: 10.12693/APhysPolA.119.860

Published: JUN 2011

Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Web of Science Core Collection: 5
Times Cited in Chinese Science Citation Database: 0
Times Cited in Russian Science Citation Index: 1
Total Times Cited: 6
ISSN: 0587-4246
Accession Number: WOS:000291836700023

Record 83 of 110
By: Plokhov, DI (Plokhov, D. I.); Zvezdin, AK (Zvezdin, A. K.); Popov, AI (Popov, A. I.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Plokhov, Dmitry	I-2141-2018	
Zvezdin, Anatoly	K-8897-2017	
Zvezdin, Anatoly	K-2072-2013	

Title: Macroscopic quantum dynamics of toroidal moment in Ising-type rare-earth clusters
Source: PHYSICAL REVIEW B
Volume: 83
Issue: 18
Article Number: 184415
DOI: 10.1103/PhysRevB.83.184415
Published: MAY 18 2011
Times Cited in BIOSIS Citation Index: 2
Times Cited in Web of Science Core Collection: 9
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 9
ISSN: 1098-0121
Accession Number: WOS:000290710500007

Record 84 of 110
By: Pedrocchi, FL (Pedrocchi, Fabio L.); Chesi, S (Chesi, Stefano); Loss, D (Loss, Daniel)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Quantum memory coupled to cavity modes
Source: PHYSICAL REVIEW B
Volume: 83
Issue: 11
Article Number: 115415
DOI: 10.1103/PhysRevB.83.115415
Published: MAR 10 2011
Times Cited in Russian Science Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 16
Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Total Times Cited: 16
ISSN: 1098-0121
Accession Number: WOS:000288212000008

Record 85 of 110
By: Fan, T (Fan, Thomas); Tsifrinovich, VI (Tsifrinovich, Vladimir I.)
Title: Measurement of a Quantum State of a Single Molecule Magnet with Magnetic Resonance Force Microscopy
Source: JOURNAL OF COMPUTATIONAL AND THEORETICAL NANOSCIENCE
Volume: 8
Issue: 3
Pages: 503-508
DOI: 10.1166/jctn.2011.1715

Published: MAR 2011
Times Cited in Chinese Science Citation Database: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 1
Times Cited in Russian Science Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Total Times Cited: 1
ISSN: 1546-1955
Accession Number: WOS:000289698100023

Record 86 of 110
By: Troiani, F (Troiani, F.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	

Title: Entanglement in finite spin rings with noncollinear Ising interaction
Source: PHYSICAL REVIEW A
Volume: 83
Issue: 2
Article Number: 022324
DOI: 10.1103/PhysRevA.83.022324
Published: FEB 24 2011
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in Web of Science Core Collection: 5
Times Cited in BIOSIS Citation Index: 0
Total Times Cited: 5
ISSN: 1050-2947
eISSN: 1094-1622
Accession Number: WOS:000287711800004

Record 87 of 110
By: Bulka, BR (Bulka, Bogdan R.); Kostyrko, T (Kostyrko, Tomasz); Luczak, J (Luczak, Jakub)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kostyrko, Tomasz		0000-0001-7849-0060

Title: Linear and nonlinear Stark effect in a triangular molecule
Source: PHYSICAL REVIEW B
Volume: 83
Issue: 3
Article Number: 035301
DOI: 10.1103/PhysRevB.83.035301
Published: JAN 10 2011
Times Cited in Web of Science Core Collection: 21
Times Cited in Chinese Science Citation Database: 1
Times Cited in Russian Science Citation Index: 0
Times Cited in BIOSIS Citation Index: 1
Times Cited in SciELO Citation Index: 0
Total Times Cited: 21
ISSN: 1098-0121
Accession Number: WOS:000286765400006

Record 88 of 110
By: Konstantinidis, NP (Konstantinidis, Nikolaos P.); Sundt, A (Sundt, Alexander); Nehrkorn, J (Nehrkorn, Joscha); Machens, A (Machens, Anna); Waldmann, O (Waldmann, Oliver)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nehrkorn, Joscha		0000-0003-1156-5675

Edited by: Spalek, J (Spalek, J)

Title: Magnetism on a Mesoscopic Scale: Molecular Nanomagnets Bridging Quantum and Classical Physics
Source: JOINT EUROPEAN MAGNETIC SYMPOSIA (JEMS)
Book Series Title: Journal of Physics Conference Series
Volume: 303
Article Number: 012003
DOI: 10.1088/1742-6596/303/1/012003
Published: 2011
Conference Title: Joint European Magnetic Symposia (JEMS)
Conference Date: AUG 23-28, 2010
Conference Location: Jagiellonian Univ, Krakow, POLAND
Sponsor(s): Jagiellonian Univ, Inst Phys
Conference Host: Jagiellonian Univ
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Web of Science Core Collection: 10
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 10
ISSN: 1742-6588
ISBN: *****************
Accession Number: WOS:000299084800003

Record 89 of 110
By: Corradini, V (Corradini, Valdis); Cervetti, C (Cervetti, Christian); Ghirri, A (Ghirri, Alberto); Biagi, R (Biagi, Roberto); del Pennino, U (del Pennino, Umberto); Timco, GA (Timco, Grigore A.); Winpenny, REP (Winpenny, Richard E. P.); Affronte, M (Affronte, Marco)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Affronte, Marco	P-2504-2016	0000-0001-5711-7822
Biagi, Roberto	C-3132-2013	0000-0002-8849-1582
Del Pennino, Umberto	L-1454-2016	0000-0001-9484-1449
GHIRRI, ALBERTO		0000-0001-7316-3765

Title: Oxo-centered carboxylate-bridged trinuclear complexes deposited on Au(111) by a mass-selective electrospray
Source: NEW JOURNAL OF CHEMISTRY
Volume: 35
Issue: 8
Pages: 1683-1689
DOI: 10.1039/c1nj20080a
Published: 2011
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 7
Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 2
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 7
ISSN: 1144-0546
eISSN: 1369-9261
Accession Number: WOS:000293087200015

Record 90 of 110
By: Troiani, F (Troiani, Filippo); Affronte, M (Affronte, Marco)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Affronte, Marco	P-2504-2016	0000-0001-5711-7822

Title: Molecular spins for quantum information technologies
Source: CHEMICAL SOCIETY REVIEWS
Volume: 40
Issue: 6
Pages: 3119-3129
DOI: 10.1039/c0cs00158a

Published: 2011
Times Cited in BIOSIS Citation Index: 11
Times Cited in Russian Science Citation Index: 1
Times Cited in Web of Science Core Collection: 196
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 2
Total Times Cited: 197
ISSN: 0306-0012
Accession Number: WOS:000290866700006
PubMed ID: 21336365

Record 91 of 110
By: Szallas, A (Szallas, A.); Troiani, F (Troiani, F.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Szallas, Attila	A-7329-2011	

Title: Decoherence of intermolecular entanglement in exchange-coupled nanomagnets
Source: PHYSICAL REVIEW B
Volume: 82
Issue: 22
Article Number: 224409
DOI: 10.1103/PhysRevB.82.224409
Published: DEC 8 2010
Times Cited in Chinese Science Citation Database: 1
Times Cited in BIOSIS Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 8
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 8
ISSN: 1098-0121
Accession Number: WOS:000286757400003

Record 92 of 110
By: Hsieh, CY (Hsieh, Chang-Yu); Hawrylak, P (Hawrylak, Pawel)
Title: Quantum circuits based on coded qubits encoded in chirality of electron spin complexes in triple quantum dots
Source: PHYSICAL REVIEW B
Volume: 82
Issue: 20
Article Number: 205311
DOI: 10.1103/PhysRevB.82.205311
Published: NOV 9 2010
Times Cited in Russian Science Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Web of Science Core Collection: 14
Times Cited in SciELO Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Total Times Cited: 14
ISSN: 2469-9950
eISSN: 2469-9969
Accession Number: WOS:000283995800005

Record 93 of 110
By: Islam, MF (Islam, M. Fhokrul); Nossa, JF (Nossa, Javier F.); Canali, CM (Canali, Carlo M.); Pederson, M (Pederson, Mark)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Islam, Md		0000-0003-1847-0863

Title: First-principles study of spin-electric coupling in a {Cu-3} single molecular magnet
Source: PHYSICAL REVIEW B
Volume: 82
Issue: 15

Article Number: 155446

DOI: 10.1103/PhysRevB.82.155446

Published: OCT 26 2010

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 31

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 3

Total Times Cited: 31

ISSN: 1098-0121

Accession Number: WOS:000283488600012

Record 94 of 110

By: Cottet, A (Cottet, Audrey); Kontos, T (Kontos, Takis)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cottet, Audrey	F-7769-2011	0000-0003-2044-7718

Title: Spin Quantum Bit with Ferromagnetic Contacts for Circuit QED

Source: PHYSICAL REVIEW LETTERS

Volume: 105

Issue: 16

Article Number: 160502

DOI: 10.1103/PhysRevLett.105.160502

Published: OCT 15 2010

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 4

Times Cited in Russian Science Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Web of Science Core Collection: 46

Total Times Cited: 46

ISSN: 0031-9007

Accession Number: WOS:000283056100003

PubMed ID: 21230956

Record 95 of 110

By: Lorusso, G (Lorusso, G.); Corradini, V (Corradini, V.); Candini, A (Candini, A.); Ghirri, A (Ghirri, A.); Biagi, R (Biagi, R.); del Pennino, U (del Pennino, U.); Carretta, S (Carretta, S.); Garlatti, E (Garlatti, E.); Santini, P (Santini, P.); Amoretti, G (Amoretti, G.); Timco, G (Timco, G.); Pritchard, RG (Pritchard, R. G.); Winpenny, REP (Winpenny, R. E. P.); Affronte, M (Affronte, M.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Lorusso, Giulia	L-9211-2013	0000-0002-4078-6808
Candini, Andrea	B-8521-2015	0000-0003-3909-473X
Biagi, Roberto	C-3132-2013	0000-0002-8849-1582
Affronte, Marco	P-2504-2016	0000-0001-5711-7822
Del Pennino, Umberto	L-1454-2016	0000-0001-9484-1449
Carretta, Stefano		0000-0002-2536-1326
GHIRRI, ALBERTO		0000-0001-7316-3765
Garlatti, Elena		0000-0002-0370-0534

Title: Probing local magnetization in molecular heterometallic Cr2Cu trimer

Source: PHYSICAL REVIEW B

Volume: 82

Issue: 14

Article Number: 144420

DOI: 10.1103/PhysRevB.82.144420

Published: OCT 11 2010

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 10

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 10
ISSN: 2469-9950
eISSN: 2469-9969
Accession Number: WOS:000282748800002

Record 96 of 110
By: Chesi, S (Chesi, Stefano); Rothlisberger, B (Roethlisberger, Beat); Loss, D (Loss, Daniel)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Self-correcting quantum memory in a thermal environment
Source: PHYSICAL REVIEW A
Volume: 82
Issue: 2
Article Number: 022305
DOI: 10.1103/PhysRevA.82.022305
Published: AUG 6 2010
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in BIOSIS Citation Index: 0
Times Cited in Web of Science Core Collection: 41
Total Times Cited: 41
ISSN: 1050-2947
Accession Number: WOS:000280688300003

Record 97 of 110
By: Trif, M (Trif, Mircea); Troiani, F (Troiani, Filippo); Stepanenko, D (Stepanenko, Dimitrije); Loss, D (Loss, Daniel)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Spin electric effects in molecular antiferromagnets
Source: PHYSICAL REVIEW B
Volume: 82
Issue: 4
Article Number: 045429
DOI: 10.1103/PhysRevB.82.045429
Published: JUL 28 2010
Times Cited in SciELO Citation Index: 0
Times Cited in Chinese Science Citation Database: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in BIOSIS Citation Index: 1
Times Cited in Web of Science Core Collection: 39
Total Times Cited: 39
ISSN: 1098-0121
Accession Number: WOS:000280469900004

Record 98 of 110
By: Chiorescu, I (Chiorescu, I.); Groll, N (Groll, N.); Bertaina, S (Bertaina, S.); Mori, T (Mori, T.); Miyashita, S (Miyashita, S.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bertaina, Sylvain	B-6841-2008	0000-0002-6466-8830
MIYASHITA, SEIJI	G-5079-2014	

Title: Magnetic strong coupling in a spin-photon system and transition to classical regime
Source: PHYSICAL REVIEW B
Volume: 82
Issue: 2
Article Number: 024413
DOI: 10.1103/PhysRevB.82.024413

Published: JUL 14 2010
Times Cited in Chinese Science Citation Database: 1
Times Cited in SciELO Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in Web of Science Core Collection: 49
Times Cited in BIOSIS Citation Index: 6
Total Times Cited: 50
ISSN: 1098-0121
Accession Number: WOS:000279887300002

Record 99 of 110
By: Schmidt, KP (Schmidt, Kai Phillip); Laad, M (Laad, Mukul)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schmidt, Kai	C-7286-2009	
Schmidt, Kai Phillip		0000-0002-8278-8238

Title: Family of Exactly Solvable Models with an Ultimate Quantum Paramagnetic Ground State
Source: PHYSICAL REVIEW LETTERS
Volume: 104
Issue: 23
Article Number: 237201
DOI: 10.1103/PhysRevLett.104.237201
Published: JUN 7 2010
Times Cited in BIOSIS Citation Index: 0
Times Cited in Russian Science Citation Index: 0
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 3
Times Cited in Chinese Science Citation Database: 0
Total Times Cited: 3
ISSN: 0031-9007
Accession Number: WOS:000278477600014
PubMed ID: 20867263

Record 100 of 110
By: Georgeot, B (Georgeot, B.); Mila, F (Mila, F.)
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Georgeot, Bertrand	D-2130-2012	0000-0002-5886-9118
Mila, Frederic		0000-0003-4306-7996

Title: Chirality of Triangular Antiferromagnetic Clusters as a Qubit
Source: PHYSICAL REVIEW LETTERS
Volume: 104
Issue: 20
Article Number: 200502
DOI: 10.1103/PhysRevLett.104.200502
Published: MAY 21 2010
Times Cited in Chinese Science Citation Database: 1
Times Cited in BIOSIS Citation Index: 1
Times Cited in SciELO Citation Index: 0
Times Cited in Web of Science Core Collection: 27
Times Cited in Russian Science Citation Index: 0
Total Times Cited: 27
ISSN: 0031-9007
Accession Number: WOS:000277945900005
PubMed ID: 20867016

Record 101 of 110

By: Khomskii, DI (Khomskii, D. I.)

Title: Spin chirality and nontrivial charge dynamics in frustrated Mott insulators: spontaneous currents and charge redistribution

Source: JOURNAL OF PHYSICS-CONDENSED MATTER

Volume: 22

Issue: 16

Article Number: 164209

DOI: 10.1088/0953-8984/22/16/164209

Published: APR 28 2010

Conference Title: International Conference on Magnetism

Conference Date: JUL 26-31, 2009

Conference Location: Karlsruhe, GERMANY

Times Cited in Chinese Science Citation Database: 0

Times Cited in BIOSIS Citation Index: 2

Times Cited in Web of Science Core Collection: 29

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 29

ISSN: 0953-8984

Accession Number: WOS:000276353200013

PubMed ID: 21386415

Record 102 of 110

By: Friedman, JR (Friedman, Jonathan R.); Sarachik, MP (Sarachik, Myriam P.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Friedman, Jonathan	A-6323-2008	0000-0003-3614-4623

Edited by: Langer, JS (Langer, JS)

Title: Single-Molecule Nanomagnets

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 1

Book Series Title: Annual Review of Condensed Matter Physics

Volume: 1

Pages: 109-128

DOI: 10.1146/annurev-conmatphys-070909-104053

Published: 2010

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 3

Times Cited in Web of Science Core Collection: 75

Times Cited in Chinese Science Citation Database: 2

Times Cited in SciELO Citation Index: 0

Total Times Cited: 75

ISSN: 1947-5454

ISBN: 978-0-8243-5001-7

Accession Number: WOS:000281964000006

Record 103 of 110

By: Belinsky, MI (Belinsky, Moisey I.)

Edited by: Goll, G (Goll, G); Lohneysen, HV (Lohneysen, HV); Loidl, A (Loidl, A); Pruschke, T (Pruschke, T); Richter, M (Richter, M); Schultz, L (Schultz, L); Surgers, C (Surgers, C); Wosnitza, J (Wosnitza, J)

Title: EPR and inelastic neutron scattering in spin-frustrated V(3) and Cu(3) nanomagnets with Dzialoshinsky-Moriya exchange

Source: INTERNATIONAL CONFERENCE ON MAGNETISM (ICM 2009)

Book Series Title: Journal of Physics Conference Series

Volume: 200

Article Number: 072011

DOI: 10.1088/1742-6596/200/7/072011

Published: 2010

Conference Title: International Conference on Magnetism (ICM 2009)

Conference Date: JUL 26-31, 2009

Conference Location: Karlsruhe, GERMANY

Sponsor(s): Univ Karlsruhe; Forschungszentrum Karlsruhe; Int Union Pure & Appl Phys; City Karlsruhe; German Natl Sci Fdn; European Commission COST MPNS

Times Cited in BIOSIS Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 5

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Total Times Cited: 5

ISSN: 1742-6588

ISBN: *****************

Accession Number: WOS:000291321302131

Record 104 of 110

By: Zak, RA (Zak, Robert Andrzej); Rothlisberger, B (Roethlisberger, Beat); Chesi, S (Chesi, Stefano); Loss, D (Loss, Daniel)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

Title: Quantum computing with electron spins in quantum dots

Source: RIVISTA DEL NUOVO CIMENTO

Volume: 33

Issue: 7

Pages: 345-399

DOI: 10.1393/ncr/i2010-10056-y

Published: 2010

Times Cited in BIOSIS Citation Index: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Web of Science Core Collection: 13

Total Times Cited: 13

ISSN: 0393-697X

eISSN: 1826-9850

Accession Number: WOS:000280505500001

Record 105 of 110

By: Zvezdin, AK (Zvezdin, A. K.); Kostyuchenko, VV (Kostyuchenko, V. V.); Popov, AI (Popov, A. I.); Popkov, AF (Popkov, A. F.); Ceulemans, A (Ceulemans, A.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zvezdin, Anatoly	K-2072-2013	
Zvezdin, Anatoly	K-8897-2017	

Title: Toroidal moment in the molecular magnet V-15

Source: PHYSICAL REVIEW B

Volume: 80

Issue: 17

Article Number: 172404

DOI: 10.1103/PhysRevB.80.172404

Published: NOV 2009

Times Cited in BIOSIS Citation Index: 1

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in Web of Science Core Collection: 11

Times Cited in SciELO Citation Index: 0

Total Times Cited: 11

ISSN: 1098-0121

Accession Number: WOS:000272310400011

Record 106 of 110

By: Popov, AI (Popov, A. I.); Plokhov, DI (Plokhov, D. I.); Zvezdin, AK (Zvezdin, A. K.)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Plokhov, Dmitry	I-2141-2018	
Zvezdin, Anatoly	K-2072-2013	
Zvezdin, Anatoly	K-8897-2017	

Title: Anapole moment and spin-electric interactions in rare-earth nanoclusters

Source: EPL

Volume: 87

Issue: 6

Article Number: 67004

DOI: 10.1209/0295-5075/87/67004

Published: SEP 2009

Times Cited in Web of Science Core Collection: 18

Times Cited in BIOSIS Citation Index: 2

Times Cited in Chinese Science Citation Database: 0

Times Cited in SciELO Citation Index: 0

Times Cited in Russian Science Citation Index: 0

Total Times Cited: 18

ISSN: 0295-5075

Accession Number: WOS:000270659600023

Record 107 of 110

By: Belinsky, MI (Belinsky, Moisey I.)

Title: Spin-frustrated V-3 and Cu-3 nanomagnets with Dzialoshinsky-Moriya exchange. 1. Inelastic neutron scattering and EPR in scalene, isosceles and equilateral trimers

Source: CHEMICAL PHYSICS

Volume: 361

Issue: 3

Pages: 137-151

DOI: 10.1016/j.chemphys.2009.05.012

Published: JUL 15 2009

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Record 108 of 110

By: Belinsky, MI (Belinsky, Moisey I.)

Title: Spin-frustrated V-3 and Cu-3 nanomagnets with Dzialoshinsky-Moriya exchange. 2. Spin structure, spin chirality and tunneling gaps

Source: CHEMICAL PHYSICS

Volume: 361

Issue: 3

Pages: 152-167

DOI: 10.1016/j.chemphys.2009.05.013

Published: JUL 15 2009

Times Cited in Russian Science Citation Index: 0

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Total Times Cited: 7

ISSN: 0301-0104

eISSN: 1873-4421

Accession Number: WOS:000268380500003

Record 109 of 110

By: Srinivasa, V (Srinivasa, Vanita); Levy, J (Levy, Jeremy)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Levy, Jeremy	A-2081-2009	0000-0002-5700-2977

Title: Tailoring effective exchange interactions via domain walls in coupled Heisenberg rings

Source: PHYSICAL REVIEW B

Volume: 80

Issue: 2

Article Number: 024414

DOI: 10.1103/PhysRevB.80.024414

Published: JUL 2009

Times Cited in Web of Science Core Collection: 7

Times Cited in SciELO Citation Index: 0

Times Cited in Chinese Science Citation Database: 0

Times Cited in Russian Science Citation Index: 0

Times Cited in BIOSIS Citation Index: 0

Total Times Cited: 7

ISSN: 1098-0121

Accession Number: WOS:000268617500065

Record 110 of 110

By: Antonosyan, D (Antonosyan, Diana); Bellucci, S (Bellucci, Stefano); Ohanyan, V (Ohanyan, Vadim)

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bellucci, Stefano	C-9235-2011	
Ohanyan, Vadim	E-6579-2011	0000-0002-7810-7321
Bellucci, Stefano		0000-0003-0326-6368

Title: Exactly solvable Ising-Heisenberg chain with triangular XXZ-Heisenberg plaquettes

Source: PHYSICAL REVIEW B

Volume: 79

Issue: 1

Article Number: 014432

DOI: 10.1103/PhysRevB.79.014432

Published: JAN 2009

Times Cited in Chinese Science Citation Database: 1

Times Cited in Russian Science Citation Index: 2

Times Cited in BIOSIS Citation Index: 0

Times Cited in Web of Science Core Collection: 41

Times Cited in SciELO Citation Index: 0

Total Times Cited: 43

ISSN: 2469-9950

eISSN: 2469-9969

Accession Number: WOS:000262977900079

Record 1 of 107

Title: Improving a Solid-State Qubit through an Engineered Mesoscopic Environment

Author(s): Ethier-Majcher, G (Ethier-Majcher, G.); Gangloff, D (Gangloff, D.); Stockill, R (Stockill, R.); Clarke, E (Clarke, E.); Hugues, M (Hugues, M.); Le Gall, C (Le Gall, C.); Atature, M (Atature, M.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 119 **Issue:** 13 **Article Number:** 130503 **DOI:** 10.1103/PhysRevLett.119.130503 **Published:** SEP 28 2017

Accession Number: WOS:000411996200002

PubMed ID: 29341723

ISSN: 0031-9007

eISSN: 1079-7114

Record 2 of 107

Title: Nuclear spin cooling by electric dipole spin resonance and coherent population trapping

Author(s): Li, AX (Li, Ai-Xian); Duan, SQ (Duan, Su-Qing); Zhang, W (Zhang, Wei)

Source: PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES **Volume:** 93 **Pages:** 105-110 **DOI:** 10.1016/j.physe.2017.06.001 **Published:** SEP 2017

Accession Number: WOS:000407746900017

ISSN: 1386-9477

eISSN: 1873-1759

Record 3 of 107

Title: Manipulation of dynamic nuclear spin polarization in single quantum dots by photonic environment engineering

Author(s): Fong, CF (Fong, C. F.); Ota, Y (Ota, Y.); Iwamoto, S (Iwamoto, S.); Arakawa, Y (Arakawa, Y.)

Source: PHYSICAL REVIEW B **Volume:** 95 **Issue:** 24 **Article Number:** 245423 **DOI:** 10.1103/PhysRevB.95.245423 **Published:** JUN 21 2017

Accession Number: WOS:000404020400006

ISSN: 2469-9950

eISSN: 2469-9969

Record 4 of 107

Title: Post-Markovian dynamics of quantum correlations: entanglement versus discord

Author(s): Mohammadi, H (Mohammadi, Hamidreza)

Source: QUANTUM INFORMATION PROCESSING **Volume:** 16 **Issue:** 2 **Article Number:** UNSP 39 **DOI:** 10.1007/s11128-016-1451-4 **Published:** FEB 2017

Accession Number: WOS:000394355800004

ISSN: 1570-0755

eISSN: 1573-1332

Record 5 of 107

Title: Quantum many-body theory for electron spin decoherence in nanoscale nuclear spin baths

Author(s): Yang, W (Yang, Wen); Ma, WL (Ma, Wen-Long); Liu, RB (Liu, Ren-Bao)

Source: REPORTS ON PROGRESS IN PHYSICS **Volume:** 80 **Issue:** 1 **Article Number:** 016001 **DOI:** 10.1088/0034-4885/80/1/016001 **Published:** JAN 2017

Accession Number: WOS:000387885500001

PubMed ID: 27811398

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Liu, Ren-Bao	B-3729-2011	0000-0002-0620-2370
Ma, Wen-Long	J-1428-2012	

ISSN: 0034-4885

eISSN: 1361-6633

Record 6 of 107

Title: Optical nuclear spin polarization in quantum dots

Author(s): Li, AX (Li, Ai-Xian); Duan, SQ (Duan, Su-Qing); Zhang, W (Zhang, Wei)

Source: CHINESE PHYSICS B **Volume:** 25 **Issue:** 10 **Article Number:** 108506 **DOI:** 10.1088/1674-1056/25/10/108506 **Published:** OCT 2016

Accession Number: WOS:000384227700083

ISSN: 1674-1056

eISSN: 1741-4199

Record 7 of 107

Title: Increased coherence time in narrowed bath states in quantum dots

Author(s): Gravert, LB (Gravert, Lars B.); Lorenz, P (Lorenz, Peter); Nase, C (Nase, Carsten); Stolze, J (Stolze, Joachim); Uhrig, GS (Uhrig, Goetz S.)

Source: PHYSICAL REVIEW B **Volume:** 94 **Issue:** 9 **Article Number:** 094416 **DOI:** 10.1103/PhysRevB.94.094416 **Published:** SEP 14 2016

Accession Number: WOS:000383139400003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nase, Carsten	C-8465-2009	0000-0002-2759-6997
Uhrig, Gotz		0000-0003-1961-0346

ISSN: 2469-9950

eISSN: 2469-9969

Record 8 of 107

Title: Inhomogeneous dynamic nuclear polarization and suppression of electron polarization decay in a quantum dot

Author(s): Wu, N (Wu, Na); Ding, WK (Ding, Wenkui); Shi, AQ (Shi, Anqi); Zhang, WX (Zhang, Wenxian)

Source: PHYSICS LETTERS A **Volume:** 380 **Issue:** 35 **Pages:** 2706-2712 **DOI:** 10.1016/j.physleta.2016.06.037 **Published:** AUG 12 2016

Accession Number: WOS:000380597100002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zhang, Wenxian	A-4274-2010	

ISSN: 0375-9601

eISSN: 1873-2429

Record 9 of 107

Title: Stabilizing nuclear spins around semiconductor electrons via the interplay of optical coherent population trapping and dynamic nuclear polarization

Author(s): Onur, AR (Onur, A. R.); de Jong, JP (de Jong, J. P.); O'Shea, D (O'Shea, D.); Reuter, D (Reuter, D.); Wieck, AD (Wieck, A. D.); van der Wal, CH (van der Wal, C. H.)

Source: PHYSICAL REVIEW B **Volume:** 93 **Issue:** 16 **Article Number:** 161204 **DOI:** 10.1103/PhysRevB.93.161204 **Published:** APR 14 2016

Accession Number: WOS:000373977400001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wieck, Andreas Dirk	C-5129-2009	0000-0001-9776-2922
van der Wal, Caspar	D-9206-2013	0000-0002-9843-3220

ISSN: 2469-9950

eISSN: 2469-9969

Record 10 of 107

Title: p-shell carrier assisted dynamic nuclear spin polarization in single quantum dots at zero external magnetic field

Author(s): Fong, CF (Fong, C. F.); Ota, Y (Ota, Y.); Harbord, E (Harbord, E.); Iwamoto, S (Iwamoto, S.); Arakawa, Y (Arakawa, Y.)

Source: PHYSICAL REVIEW B **Volume:** 93 **Issue:** 12 **Article Number:** 125306 **DOI:** 10.1103/PhysRevB.93.125306 **Published:** MAR 16 2016

Accession Number: WOS:000372413000007

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eISSN: 2469-9969

Record 11 of 107

Title: Competition between electric field and magnetic field noise in the decoherence of a single spin in diamond

Author(s): Jamonneau, P (Jamonneau, P.); Lesik, M (Lesik, M.); Tetienne, JP (Tetienne, J. P.); Alvizu, I (Alvizu, I.); Mayer, L (Mayer, L.); Dreau, A (Dreau, A.); Kosen, S (Kosen, S.); Roch, JF (Roch, J. -F.); Pezzagna, S (Pezzagna, S.); Meijer, J (Meijer, J.); Teraji, T (Teraji, T.); Kubo, Y (Kubo, Y.); Bertet, P (Bertet, P.); Maze, JR (Maze, J. R.); Jacques, V (Jacques, V.)

Source: PHYSICAL REVIEW B **Volume:** 93 **Issue:** 2 **Article Number:** 024305 **DOI:** 10.1103/PhysRevB.93.024305 **Published:** JAN 25 2016

Accession Number: WOS:000369218500005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dreau, Anais	Q-5946-2017	
Jacques, Vincent	D-3881-2014	
Tetienne, Jean-Philippe	H-4896-2014	0000-0001-5796-2508
Kubo, Yuimaru	I-6546-2013	0000-0001-5803-4287
Kosen, Sandoko		0000-0001-9560-9932
Maze, Jeronimo		0000-0003-0751-9182

ISSN: 2469-9950

eISSN: 2469-9969

Record 12 of 107

Title: Maximizing the purity of a qubit evolving in an anisotropic environment

Author(s): Wang, XYJ (Wang, Xiaoya Judy); Chesi, S (Chesi, Stefano); Coish, WA (Coish, W. A.)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 11 **Article Number:** 115424 **DOI:** 10.1103/PhysRevB.92.115424 **Published:** SEP 17 2015

Accession Number: WOS:000361301600001

ISSN: 1098-0121

eISSN: 1550-235X

Record 13 of 107

Title: Theory of box-model hyperfine couplings and transport signatures of long-range nuclear-spin coherence in a quantum-dot spin valve

Author(s): Chesi, S (Chesi, Stefano); Coish, WA (Coish, W. A.)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 24 **Article Number:** 245306 **DOI:** 10.1103/PhysRevB.91.245306 **Published:** JUN 12 2015

Accession Number: WOS:000356135600004

ISSN: 1098-0121

eISSN: 1550-235X

Record 14 of 107

Title: Valence band mixing versus higher harmonic generation in electric-dipole spin resonance

Author(s): Pasek, WJ (Pasek, W. J.); Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.)

Source: SEMICONDUCTOR SCIENCE AND TECHNOLOGY **Volume:** 30 **Issue:** 5 **Article Number:** 055017 **DOI:** 10.1088/0268-1242/30/5/055017 **Published:** MAY 2015

Accession Number: WOS:000355212600021

Author Identifiers:

Author	ResearcherID Number	ORCID Number
szafran, bartlomiej	A-1936-2017	
Szafran, Bartlomiej		0000-0001-6938-3247
Nowak, Michal		0000-0002-1877-2055

ISSN: 0268-1242

eISSN: 1361-6641

Record 15 of 107

Title: Dynamics of entanglement of two electron spins interacting with nuclear spin baths in quantum dots

Author(s): Bragar, I (Bragar, Igor); Cywinski, L (Cywinski, Lukasz)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 15 **Article Number:** 155310 **DOI:** 10.1103/PhysRevB.91.155310 **Published:** APR 24 2015

Accession Number: WOS:000353449700004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cywinski, Lukasz	E-5348-2010	0000-0002-0162-7943
Bragar, Igor	B-8654-2012	0000-0003-1321-2371

ISSN: 1098-0121

eISSN: 1550-235X

Record 16 of 107

Title: Coherent Population Trapping, Nuclear Spin Cooling, and Levy Flights in Solid-State Atom-Like Systems

Author(s): Singh, S (Singh, Swati); Chu, YW (Chu, Yiwen); Lukin, M (Lukin, Mikhail); Yelin, S (Yelin, Susanne)

Edited by: Arimondo E; Lin CC; Yelin SF

Source: ADVANCES IN ATOMIC, MOLECULAR, AND OPTICAL PHYSICS, VOL 64 **Book Series:** Advances In Atomic Molecular and Optical Physics **Volume:** 64 **Pages:** 273-327 **DOI:** 10.1016/bs.aamop.2015.05.001 **Published:** 2015

Accession Number: WOS:000370490900012

ISSN: 1049-250X

ISBN: 978-0-12-802127-9

Record 17 of 107

Title: Probing the Dynamics of a Nuclear Spin Bath in Diamond through Time-Resolved Central Spin Magnetometry

Author(s): Dreau, A (Dreau, A.); Jamonneau, P (Jamonneau, P.); Gazzano, O (Gazzano, O.); Kosen, S (Kosen, S.); Roch, JF (Roch, J. -F.); Maze, JR (Maze, J. R.); Jacques, V (Jacques, V.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 113 **Issue:** 13 **Article Number:** 137601 **DOI:** 10.1103/PhysRevLett.113.137601 **Published:** SEP 22 2014

Accession Number: WOS:000344051400005

PubMed ID: 25302916

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Jacques, Vincent	D-3881-2014	
Dreau, Anais	Q-5946-2017	
Maze, Jeronimo		0000-0003-0751-9182
Kosen, Sandoko		0000-0001-9560-9932

ISSN: 0031-9007

eISSN: 1079-7114

Record 18 of 107

Title: Fidelity of optically induced single-spin rotations in semiconductor quantum dots in the presence of nuclear spins

Author(s): Hildmann, J (Hildmann, Julia); Burkard, G (Burkard, Guido)

Source: PHYSICA STATUS SOLIDI B-BASIC SOLID STATE PHYSICS **Volume:** 251 **Issue:** 9 **Special Issue:** SI **Pages:** 1938-1944 **DOI:** 10.1002/pssb.201350412 **Published:** SEP 2014

Accession Number: WOS:000342136300026

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 0370-1972

eISSN: 1521-3951

Record 19 of 107

Title: Controlling hole spins in quantum dots and wells

Author(s): Chesi, S (Chesi, Stefano); Wang, XJ (Wang, Xiaoya Judy); Coish, WA (Coish, W. A.)

Source: EUROPEAN PHYSICAL JOURNAL PLUS **Volume:** 129 **Issue:** 5 **Article Number:** 86 **DOI:** 10.1140/epjp/i2014-14086-2 **Published:** MAY 20 2014

Accession Number: WOS:000336382600001

ISSN: 2190-5444

Record 20 of 107

Title: Recombination dynamics of excitons bound to nitrogen isoelectronic centers in delta-doped GaP

Author(s): St-Jean, P (St-Jean, P.); Ethier-Majcher, G (Ethier-Majcher, G.); Sakuma, Y (Sakuma, Y.); Francoeur, S (Francoeur, S.)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 7 **Article Number:** 075308 **DOI:** 10.1103/PhysRevB.89.075308 **Published:** FEB 19 2014

Accession Number: WOS:000332397300005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
SAKUMA, Yoshiki	H-2970-2011	0000-0001-6804-7217
Francoeur, Sebastien	E-6614-2011	0000-0002-6129-7026

ISSN: 1098-0121

eISSN: 1550-235X

Record 21 of 107

Title: Enhanced hyperfine-induced spin dephasing in a magnetic-field gradient

Author(s): Beaudoin, F (Beaudoin, Felix); Coish, WA (Coish, W. A.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 8 **Article Number:** 085320 **DOI:** 10.1103/PhysRevB.88.085320 **Published:** AUG 27 2013

Accession Number: WOS:000323609000001

ISSN: 1098-0121

Record 22 of 107

Title: Dynamic nuclear polarization in InGaAs/GaAs and GaAs/AlGaAs quantum dots under nonresonant ultralow-power optical excitation

Author(s): Puebla, J (Puebla, J.); Chekhovich, EA (Chekhovich, E. A.); Hopkinson, M (Hopkinson, M.); Senellart, P (Senellart, P.); Lemaitre, A (Lemaitre, A.); Skolnick, MS (Skolnick, M. S.); Tartakovskii, AI (Tartakovskii, A. I.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 4 **Article Number:** 045306 **DOI:** 10.1103/PhysRevB.88.045306 **Published:** JUL 8 2013

Accession Number: WOS:000321670400010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Skolnick, Maurice	G-7250-2016	0000-0002-3972-8344
SENELLART, Pascale	C-1771-2017	0000-0002-8727-1086
Chekhovich, Evgeny	J-8604-2012	0000-0003-1626-9015
Hopkinson, Mark	H-8239-2012	
Lemaitre, Aristide	B-9899-2009	0000-0003-1892-9726
Hopkinson, Mark		0000-0002-8097-6913

ISSN: 2469-9950

eISSN: 2469-9969

Record 23 of 107

Title: The Nuclear Dark State under Dynamical Nuclear Polarization

Author(s): Yu, HY (Yu Hong-Yi); Luo, Y (Luo Yu); Yao, W (Yao Wang)

Source: CHINESE PHYSICS LETTERS **Volume:** 30 **Issue:** 7 **Article Number:** 077302 **DOI:** 10.1088/0256-307X/30/7/077302 **Published:** JUL 2013

Accession Number: WOS:000321763700045

ISSN: 0256-307X

Record 24 of 107

Title: GEOMETRIC PHASE OF SPIN CHAIN SYSTEM IN THE NONEQUILIBRIUM THERMAL ENVIRONMENTS

Author(s): Zhang, XX (Zhang, Xiu-Xing); Zhang, AP (Zhang, Ai-Ping); Zhang, J (Zhang, Jia); Wang, JX (Wang, Ju-Xia)

Source: MODERN PHYSICS LETTERS B **Volume:** 27 **Issue:** 11 **Article Number:** 1350078 **DOI:** 10.1142/S0217984913500784 **Published:** MAY 10 2013

Accession Number: WOS:000317422500007

ISSN: 0217-9849

eISSN: 1793-6640

Record 25 of 107

Title: Anisotropy of dipolar-broadened nuclear spin resonance

Author(s): Tsyplyatyev, O (Tsyplyatyev, Oleksandr); Avotina, Y (Avotina, Yevgeniya)

Book Group Author(s): IOP

Source: 20TH INTERNATIONAL CONFERENCE ON THE APPLICATION OF HIGH MAGNETIC FIELDS IN SEMICONDUCTOR PHYSICS (HMF-20) **Book Series:** Journal of Physics Conference Series **Volume:** 456 **Article Number:** UNSP 012037 **DOI:** 10.1088/1742-6596/456/1/012037 **Published:** 2013

Accession Number: WOS:000324548700037

Conference Title: 20th International Conference on the Application of High Magnetic Fields in Semiconductor Physics (HMF)

Conference Date: JUL 22-27, 2012

Conference Location: Chamonix, FRANCE

Conference Sponsors: Lab Natl Champs Magnetiques Intenses, European High Magnet Field Lab

ISSN: 1742-6588

Record 26 of 107

Title: Prospects for Spin-Based Quantum Computing in Quantum Dots

Author(s): Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Edited by: Langer JS

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 4 **Book Series:** Annual Review of Condensed Matter Physics **Volume:** 4 **Pages:** 51-81 **DOI:** 10.1146/annurev-conmatphys-030212-184248 **Published:** 2013

Accession Number: WOS:000321694300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1947-5454

ISBN: 978-0-8243-5004-8

Record 27 of 107

Title: Theory of spin relaxation in two-electron laterally coupled Si/SiGe quantum dots

Author(s): Raith, M (Raith, Martin); Stano, P (Stano, Peter); Fabian, J (Fabian, Jaroslav)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 20 **Article Number:** 205321 **DOI:** 10.1103/PhysRevB.86.205321 **Published:** NOV 28 2012

Accession Number: WOS:000311605000004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525
Stano, Peter	C-3016-2013	0000-0001-5835-0765
Raith, Martin	A-3357-2011	

ISSN: 1098-0121

Record 28 of 107

Title: B-field dependence of the electron spin resonance line shape in a quantum dot

Author(s): Tsyplyatyev, O (Tsyplyatyev, O.)

Source: PHYSICA SCRIPTA **Volume:** T151 **Article Number:** 014050 **DOI:** 10.1088/0031-8949/2012/T151/014050 **Published:** NOV 2012

Accession Number: WOS:000311961700051

ISSN: 0031-8949

Record 29 of 107

Title: Manipulation of qubits in nonorthogonal collective storage modes

Author(s): Refsgaard, J (Refsgaard, Jonas); Molmer, K (Molmer, Klaus)

Source: PHYSICAL REVIEW A **Volume:** 86 **Issue:** 2 **Article Number:** 022302 **DOI:** 10.1103/PhysRevA.86.022302 **Published:** AUG 1 2012

Accession Number: WOS:000306991200004

ISSN: 1050-2947

Record 30 of 107

Title: Spin decoherence in graphene quantum dots due to hyperfine interaction

Author(s): Fuchs, M (Fuchs, Moritz); Rychkov, V (Rychkov, Valentin); Trauzettel, B (Trauzettel, Bjoern)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 8 **Article Number:** 085301 **DOI:** 10.1103/PhysRevB.86.085301 **Published:** AUG 1 2012

Accession Number: WOS:000306993300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trauzettel, Bjoern	C-4011-2017	0000-0002-7342-8425
Rychkov, Valentin		0000-0003-2825-9076

ISSN: 2469-9950

eISSN: 2469-9969

Record 31 of 107

Title: Effect of strain on hyperfine-induced hole-spin decoherence in quantum dots

Author(s): Maier, F (Maier, Franziska); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 19 **Article Number:** 195323 **DOI:** 10.1103/PhysRevB.85.195323 **Published:** MAY 24 2012

Accession Number: WOS:000304395300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 32 of 107

Title: Persistent Narrowing of Nuclear-Spin Fluctuations in InAs Quantum Dots Using Laser Excitation

Author(s): Sun, B (Sun, Bo); Chow, CME (Chow, Colin Ming Earn); Steel, DG (Steel, Duncan G.); Bracker, AS (Bracker, Allan S.); Gammon, D (Gammon, Daniel); Sham, LJ (Sham, L. J.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 108 **Issue:** 18 **Article Number:** 187401 **DOI:** 10.1103/PhysRevLett.108.187401 **Published:** MAY 1 2012

Accession Number: WOS:000303384400012

PubMed ID: 22681117

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Sham, Lu		0000-0001-5718-2077

ISSN: 0031-9007

eISSN: 1079-7114

Record 33 of 107

Title: Entanglement Dynamics of Electron Spins in Quantum Dots Under a Nonuniform Magnetic Field

Author(s): Zhou, FX (Zhou, Feng-Xue); Qi, YH (Qi, Yi-Hong); Niu, YP (Niu, Yue-Ping); Gong, SQ (Gong, Shang-Qing); Qian, J (Qian, Jun); Yu, T (Yu, Ting)

Source: JOURNAL OF THE KOREAN PHYSICAL SOCIETY **Volume:** 60 **Issue:** 8 **Pages:** 1238-1244 **DOI:** 10.3938/jkps.60.1238 **Published:** APR 2012

Accession Number: WOS:000304100200009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yu, Ting	A-3616-2011	
Qi, Yihong		0000-0002-1567-4345

ISSN: 0374-4884

Record 34 of 107

Title: Dipolar broadening of nuclear spin resonance under dynamical pumping

Author(s): Tsyplyatyev, O (Tsyplyatyev, O.); Whittaker, DM (Whittaker, D. M.)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 12 **Article Number:** 125123 **DOI:** 10.1103/PhysRevB.85.125123 **Published:** MAR 22 2012

Accession Number: WOS:000301838100004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Whittaker, David	G-5148-2011	

ISSN: 1098-0121

Record 35 of 107

Title: Persistent optical nuclear spin narrowing in a singly charged InAs quantum dot

Author(s): Sun, B (Sun, Bo); Yao, W (Yao, Wang); Xu, XD (Xu, Xiaodong); Bracker, AS (Bracker, Allan S.); Gammon, D (Gammon, Daniel); Sham, LJ (Sham, L. J.); Steel, D (Steel, Duncan)

Source: JOURNAL OF THE OPTICAL SOCIETY OF AMERICA B-OPTICAL PHYSICS **Volume:** 29 **Issue:** 2 **Pages:** A119-A126 **DOI:** 10.1364/JOSAB.29.00A119 **Published:** FEB 2012

Accession Number: WOS:000300407300016

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Sham, Lu		0000-0001-5718-2077

ISSN: 0740-3224

Record 36 of 107

Title: Role of hyperfine interaction for cavity-mediated coupling between spin qubits

Author(s): Hildmann, J (Hildmann, Julia); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 84 **Issue:** 20 **Article Number:** 205127 **DOI:** 10.1103/PhysRevB.84.205127 **Published:** NOV 17 2011

Accession Number: WOS:000297106600001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 1098-0121

Record 37 of 107

Title: Generating Entanglement and Squeezed States of Nuclear Spins in Quantum Dots

Author(s): Rudner, MS (Rudner, M. S.); Vandersypen, LMK (Vandersypen, L. M. K.); Vuletic, V (Vuletic, V.); Levitov, LS (Levitov, L. S.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 107 **Issue:** 20 **Article Number:** 206806 **DOI:** 10.1103/PhysRevLett.107.206806 **Published:** NOV 8 2011

Accession Number: WOS:000297130800011

PubMed ID: 22181759

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rudner, Mark	C-9325-2015	0000-0002-5150-6234
Levitov, Leonid		0000-0002-4268-731X

ISSN: 0031-9007

Record 38 of 107

Title: Generation of non-equilibrium thermal quantum discord and entanglement in a three-spin XX chain by multi-spin interaction and an external magnetic field

Author(s): Zhang, XX (Zhang, Xiu-xing); Li, FL (Li, Fu-li)

Source: PHYSICS LETTERS A **Volume:** 375 **Issue:** 46 **Pages:** 4130-4137 **DOI:** 10.1016/j.physleta.2011.10.004 **Published:** NOV 7 2011

Accession Number: WOS:000296997100004

ISSN: 0375-9601

Record 39 of 107

Title: Controlling transfer of quantum correlations among bi-partitions of a composite quantum system by combining different noisy environments

Author(s): Xiu-Xing, Z (Xiu-Xing, Zhang); Fu-Li, L (Fu-Li, Li)

Source: CHINESE PHYSICS B **Volume:** 20 **Issue:** 11 **Article Number:** 110302 **DOI:** 10.1088/1674-1056/20/11/110302 **Published:** NOV 2011

Accession Number: WOS:000298491700007

ISSN: 1674-1056

eISSN: 1741-4199

Record 40 of 107

Title: Laser cooling and real-time measurement of the nuclear spin environment of a solid-state qubit

Author(s): Togan, E (Togan, E.); Chu, Y (Chu, Y.); Imamoglu, A (Imamoglu, A.); Lukin, MD (Lukin, M. D.)

Source: NATURE **Volume:** 478 **Issue:** 7370 **Pages:** 497-501 **DOI:** 10.1038/nature10528 **Published:** OCT 27 2011

Accession Number: WOS:000296194200039

PubMed ID: 22031442

ISSN: 0028-0836

Record 41 of 107

Title: Controlling the nuclear polarization in quantum dots using optical pulse shape with a modest bandwidth

Author(s): Carter, SG (Carter, S. G.); Economou, SE (Economou, Sophia E.); Shabaev, A (Shabaev, A.); Bracker, AS (Bracker, A. S.)

Source: PHYSICAL REVIEW B **Volume:** 83 **Issue:** 11 **Article Number:** 115325 **DOI:** 10.1103/PhysRevB.83.115325 **Published:** MAR 23 2011

Accession Number: WOS:000288695200005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Carter, Sam	G-4589-2012	0000-0001-8842-2053

ISSN: 1098-0121

Record 42 of 107

Title: Spectrum of an Electron Spin Coupled to an Unpolarized Bath of Nuclear Spins

Author(s): Tsyplyatyev, O (Tsyplyatyev, Oleksandr); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW LETTERS **Volume:** 106 **Issue:** 10 **Article Number:** 106803 **DOI:** 10.1103/PhysRevLett.106.106803 **Published:** MAR 8 2011

Accession Number: WOS:000288123300016

PubMed ID: 21469823

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0031-9007

Record 43 of 107

Title: Hybridization and Spin Decoherence in Heavy-Hole Quantum Dots

Author(s): Fischer, J (Fischer, Jan); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW LETTERS **Volume:** 105 **Issue:** 26 **Article Number:** 266603 **DOI:** 10.1103/PhysRevLett.105.266603 **Published:** DEC 22 2010

Accession Number: WOS:000286756800020

PubMed ID: 21231694

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0031-9007

Record 44 of 107

Title: Nuclear Spin Cooling Using Overhauser-Field Selective Coherent Population Trapping

Author(s): Issler, M (Issler, M.); Kessler, EM (Kessler, E. M.); Giedke, G (Giedke, G.); Yelin, S (Yelin, S.); Cirac, I (Cirac, I.); Lukin, MD (Lukin, M. D.); Imamoglu, A (Imamoglu, A.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 105 **Issue:** 26 **Article Number:** 267202 **DOI:** 10.1103/PhysRevLett.105.267202 **Published:** DEC 21 2010

Accession Number: WOS:000286755900004

PubMed ID: 21231709

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cirac, Ignacio	A-9105-2017	0000-0003-3359-1743
Kessler, Eric Matthias	E-6981-2012	0000-0001-9959-538X
Giedke, Geza		0000-0002-9676-5686

ISSN: 0031-9007

Record 45 of 107

Title: Feedback control of nuclear hyperfine fields in a double quantum dot

Author(s): Yao, W (Yao, Wang); Luo, Y (Luo, Yu)

Source: EPL **Volume:** 92 **Issue:** 1 **Article Number:** 17008 **DOI:** 10.1209/0295-5075/92/17008 **Published:** OCT 2010

Accession Number: WOS:000284469900031

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yao, Wang	C-1353-2008	0000-0003-2883-4528

ISSN: 0295-5075

Record 46 of 107

Title: Harnessing the GaAs quantum dot nuclear spin bath for quantum control

Author(s): Ribeiro, H (Ribeiro, Hugo); Petta, JR (Petta, J. R.); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 11 **Article Number:** 115445 **DOI:** 10.1103/PhysRevB.82.115445 **Published:** SEP 24 2010

Accession Number: WOS:000282125700005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Petta, Jason	J-6663-2013	0000-0002-6416-0789

ISSN: 1098-0121

Record 47 of 107

Title: Spin dynamics in semiconductors

Author(s): Wu, MW (Wu, M. W.); Jiang, JH (Jiang, J. H.); Weng, MQ (Weng, M. Q.)

Source: PHYSICS REPORTS-REVIEW SECTION OF PHYSICS LETTERS **Volume:** 493 **Issue:** 2-4 **Pages:** 61-236 **DOI:** 10.1016/j.physrep.2010.04.002 **Published:** AUG 2010
Accession Number: WOS:000281524100001
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Jiang, Jian-Hua	L-5051-2018	0000-0001-6505-0998

ISSN: 0370-1573
eISSN: 1873-6270

Record 48 of 107
Title: Protection of center-spin coherence by a dynamically polarized nuclear spin core
Author(s): Zhang, WX (Zhang, Wenxian); Hu, JL (Hu, Jian-Liang); Zhuang, J (Zhuang, Jun); You, JQ (You, J. Q.); Liu, RB (Liu, Ren-Bao)
Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 4 **Article Number:** 045314 **DOI:** 10.1103/PhysRevB.82.045314 **Published:** JUL 23 2010
Accession Number: WOS:000280231100008
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Liu, Ren-Bao	B-3729-2011	0000-0002-0620-2370
Zhang, Wenxian	A-4274-2010	

ISSN: 1098-0121

Record 49 of 107
Title: Dynamical cooling of nuclear spins in double quantum dots
Author(s): Rudner, MS (Rudner, M. S.); Levitov, LS (Levitov, L. S.)
Source: NANOTECHNOLOGY **Volume:** 21 **Issue:** 27 **Article Number:** 274016 **DOI:** 10.1088/0957-4484/21/27/274016 **Published:** JUL 9 2010
Accession Number: WOS:000279004100018
PubMed ID: 20571203
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rudner, Mark	C-9325-2015	0000-0002-5150-6234
Levitov, Leonid		0000-0002-4268-731X

ISSN: 0957-4484

Record 50 of 107
Title: Free-induction decay and envelope modulations in a narrowed nuclear spin bath
Author(s): Coish, WA (Coish, W. A.); Fischer, J (Fischer, Jan); Loss, D (Loss, Daniel)
Source: PHYSICAL REVIEW B **Volume:** 81 **Issue:** 16 **Article Number:** 165315 **DOI:** 10.1103/PhysRevB.81.165315 **Published:** APR 15 2010
Accession Number: WOS:000277217200071
Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coish, William	A-5521-2008	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 51 of 107

Title: Non-equilibrium entanglement dynamics of a two-qubit Heisenberg XY system in the presence of an inhomogeneous magnetic field and spin-orbit interaction

Author(s): Kheirandish, F (Kheirandish, F.); Akhtarshenas, SJ (Akhtarshenas, S. J.); Mohammadi, H (Mohammadi, H.)

Source: EUROPEAN PHYSICAL JOURNAL D **Volume:** 57 **Issue:** 1 **Pages:** 129-140 **DOI:** 10.1140/epjd/e2010-00003-2 **Published:** MAR 2010

Accession Number: WOS:000275125100019

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Akhtarshenas, Seyed Javad	F-5916-2017	0000-0002-9615-7816
Mohammadi, Hamidreza		0000-0001-7046-3818

ISSN: 1434-6060

Record 52 of 107

Title: Quantum computing by optical control of electron spins

Author(s): Liu, RB (Liu, Ren-Bao); Yao, W (Yao, Wang); Sham, LJ (Sham, L. J.)

Source: ADVANCES IN PHYSICS **Volume:** 59 **Issue:** 5 **Pages:** 703-802 **Article Number:** PII 925641728 **DOI:** 10.1080/00018732.2010.505452 **Published:** 2010

Accession Number: WOS:000281699600002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Liu, Ren-Bao	B-3729-2011	0000-0002-0620-2370
Sham, Lu		0000-0001-5718-2077

ISSN: 0001-8732

eISSN: 1460-6976

Record 53 of 107

Title: Magnetic order in nuclear spin two-dimensional lattices due to electron-electron interactions

Author(s): Simon, P (Simon, Pascal); Braunecker, B (Braunecker, Bernd); Loss, D (Loss, Daniel)

Source: PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES **Volume:** 42 **Issue:** 3 **Pages:** 634-638 **DOI:** 10.1016/j.physe.2009.06.058 **Published:** JAN 2010

Accession Number: WOS:000274954500075

Conference Title: International Conference on Frontiers of Quantum and Mesoscopic Thermodynamics (FQMT '08)

Conference Date: JUL 28-AUG 02, 2008

Conference Location: Prague, CZECH REPUBLIC

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1386-9477

Record 54 of 107

Title: Quantum computing with electron spins in quantum dots

Author(s): Zak, RA (Zak, Robert Andrzej); Rothlisberger, B (Roethlisberger, Beat); Chesi, S (Chesi, Stefano); Loss, D (Loss, Daniel)

Source: RIVISTA DEL NUOVO CIMENTO **Volume:** 33 **Issue:** 7 **Pages:** 345-399 **DOI:** 10.1393/ncr/i2010-10056-y **Published:** 2010

Accession Number: WOS:000280505500001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0393-697X

eISSN: 1826-9850

Record 55 of 107

Title: Measurement of the Knight field and local nuclear dipole-dipole field in an InGaAs/GaAs quantum dot ensemble

Author(s): Auer, T (Auer, T.); Oulton, R (Oulton, R.); Bauschulte, A (Bauschulte, A.); Yakovlev, DR (Yakovlev, D. R.); Bayer, M (Bayer, M.); Verbin, SY (Verbin, S. Yu.); Cherbunin, RV (Cherbunin, R. V.); Reuter, D (Reuter, D.); Wieck, AD (Wieck, A. D.)

Source: PHYSICAL REVIEW B **Volume:** 80 **Issue:** 20 **Article Number:** 205303 **DOI:** 10.1103/PhysRevB.80.205303 **Published:** NOV 2009

Accession Number: WOS:000272311400061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wieck, Andreas Dirk	C-5129-2009	0000-0001-9776-2922
Verbin, Serge	C-5189-2011	0000-0001-5791-7707
Yakovlev, Dmitri		0000-0001-7349-2745

ISSN: 1098-0121

Record 56 of 107

Title: Locking electron spins into magnetic resonance by electron-nuclear feedback

Author(s): Vink, IT (Vink, Ivo T.); Nowack, KC (Nowack, Katja C.); Koppens, FHL (Koppens, Frank H. L.); Danon, J (Danon, Jeroen); Nazarov, YV (Nazarov, Yuli V.); Vandersypen, LMK (Vandersypen, Lieven M. K.)

Source: NATURE PHYSICS **Volume:** 5 **Issue:** 10 **Pages:** 764-768 **DOI:** 10.1038/NPHYS1366 **Published:** OCT 2009

Accession Number: WOS:000271185400019

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nazarov, Yuli	F-6511-2011	
Danon, Jeroen	E-6641-2015	0000-0001-8088-8772
Koppens, Frank		0000-0001-9764-6120

ISSN: 1745-2473

Record 57 of 107

Title: Nuclear spins in nanostructures

Author(s): Coish, WA (Coish, W. A.); Baugh, J (Baugh, J.)

Source: PHYSICA STATUS SOLIDI B-BASIC SOLID STATE PHYSICS **Volume:** 246 **Issue:** 10 **Pages:** 2203-2215 **DOI:** 10.1002/pssb.200945229 **Published:** OCT 2009

Accession Number: WOS:000271005100001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Baugh, Jonathan	F-3879-2011	
Coish, William	A-5521-2008	
Baugh, Jonathan		0000-0002-9300-7134

ISSN: 0370-1972

Record 58 of 107

Title: Optically controlled locking of the nuclear field via coherent dark-state spectroscopy

Author(s): Xu, XD (Xu, Xiaodong); Yao, W (Yao, Wang); Sun, B (Sun, Bo); Steel, DG (Steel, Duncan G.); Bracker, AS (Bracker, Allan S.); Gammon, D (Gammon, Daniel); Sham, LJ (Sham, L. J.)

Source: NATURE **Volume:** 459 **Issue:** 7250 **Pages:** 1105-1109 **DOI:** 10.1038/nature08120 **Published:** JUN 25 2009

Accession Number: WOS:000267636700038

PubMed ID: 19553994

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Sham, Lu		0000-0001-5718-2077

ISSN: 0028-0836

eISSN: 1476-4687

Record 59 of 107

Title: Pure quantum dephasing of a solid-state electron spin qubit in a large nuclear spin bath coupled by long-range hyperfine-mediated interactions

Author(s): Cywinski, L (Cywinski, Lukasz); Witzel, WM (Witzel, Wayne M.); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW B **Volume:** 79 **Issue:** 24 **Article Number:** 245314 **DOI:** 10.1103/PhysRevB.79.245314 **Published:** JUN 2009

Accession Number: WOS:000267699700090

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cywinski, Lukasz	E-5348-2010	0000-0002-0162-7943
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X

ISSN: 1098-0121

Record 60 of 107

Title: Nuclear State Preparation via Landau-Zener-Stuckelberg Transitions in Double Quantum Dots

Author(s): Ribeiro, H (Ribeiro, Hugo); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW LETTERS **Volume:** 102 **Issue:** 21 **Article Number:** 216802 **DOI:** 10.1103/PhysRevLett.102.216802 **Published:** MAY 29 2009

Accession Number: WOS:000266501600040

PubMed ID: 19519124

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 0031-9007

Record 61 of 107

Title: Directing Nuclear Spin Flips in InAs Quantum Dots Using Detuned Optical Pulse Trains

Author(s): Carter, SG (Carter, S. G.); Shabaev, A (Shabaev, A.); Economou, SE (Economou, Sophia E.); Kennedy, TA (Kennedy, T. A.); Bracker, AS (Bracker, A. S.); Reinecke, TL (Reinecke, T. L.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 102 **Issue:** 16 **Article Number:** 167403 **DOI:** 10.1103/PhysRevLett.102.167403 **Published:** APR 24 2009

Accession Number: WOS:000265479300070

PubMed ID: 19518754

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Carter, Sam	G-4589-2012	0000-0001-8842-2053

ISSN: 0031-9007

Record 62 of 107

Title: Effect of nuclear polarization on spin dynamics in a double quantum dot

Author(s): Sarkka, J (Sarkka, J.); Harju, A (Harju, A.)

Source: PHYSICAL REVIEW B **Volume:** 79 **Issue:** 8 **Article Number:** 085313 **DOI:** 10.1103/PhysRevB.79.085313 **Published:** FEB 2009

Accession Number: WOS:000263816000058

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harju, Ari	C-2828-2009	0000-0002-2233-2896

ISSN: 1098-0121

Record 63 of 107

Title: Nuclear spin dynamics and Zeno effect in quantum dots and defect centers

Author(s): Klauser, D (Klauser, D.); Coish, WA (Coish, W. A.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 78 **Issue:** 20 **Article Number:** 205301 **DOI:** 10.1103/PhysRevB.78.205301 **Published:** NOV 2008

Accession Number: WOS:000261215400040

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Coish, William	A-5521-2008	

ISSN: 1098-0121

Record 64 of 107

Title: Spin decoherence of a heavy hole coupled to nuclear spins in a quantum dot

Author(s): Fischer, J (Fischer, Jan); Coish, WA (Coish, W. A.); Bulaev, DV (Bulaev, D. V.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 78 **Issue:** 15 **Article Number:** 155329 **DOI:** 10.1103/PhysRevB.78.155329 **Published:** OCT 2008

Accession Number: WOS:000260574400107

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coish, William	A-5521-2008	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 65 of 107

Title: Entanglement generation via a completely mixed nuclear spin bath

Author(s): Christ, H (Christ, H.); Cirac, JI (Cirac, J. I.); Giedke, G (Giedke, G.)

Source: PHYSICAL REVIEW B **Volume:** 78 **Issue:** 12 **Article Number:** 125314 **DOI:** 10.1103/PhysRevB.78.125314 **Published:** SEP 2008

Accession Number: WOS:000259691500055

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cirac, Ignacio	A-9105-2017	0000-0003-3359-1743

Giedke, Geza		0000-0002-9676-5686

ISSN: 1098-0121

Record 66 of 107

Title: Suppressing spin qubit dephasing by nuclear state preparation

Author(s): Reilly, DJ (Reilly, D. J.); Taylor, JM (Taylor, J. M.); Petta, JR (Petta, J. R.); Marcus, CM (Marcus, C. M.); Hanson, MP (Hanson, M. P.); Gossard, AC (Gossard, A. C.)

Source: SCIENCE **Volume:** 321 **Issue:** 5890 **Pages:** 817-821 **DOI:** 10.1126/science.1159221 **Published:** AUG 8 2008

Accession Number: WOS:000258261000040

PubMed ID: 18687959

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Taylor, Jacob	B-7826-2011	0000-0003-0493-5594
Marcus, Charles	M-4526-2014	0000-0003-2420-4692
Reilly, David	N-8448-2015	
Petta, Jason	J-6663-2013	0000-0002-6416-0789

ISSN: 0036-8075

Record 67 of 107

Title: Numerical study of a quantum dot structure for entanglement generation

Author(s): Giavaras, G (Giavaras, George)

Source: SEMICONDUCTOR SCIENCE AND TECHNOLOGY **Volume:** 23 **Issue:** 8 **Article Number:** 085010 **DOI:** 10.1088/0268-1242/23/10/085010 **Published:** AUG 2008

Accession Number: WOS:000257938100010

ISSN: 0268-1242

Record 68 of 107

Title: Quenching spin decoherence in diamond through spin bath polarization

Author(s): Takahashi, S (Takahashi, Susumu); Hanson, R (Hanson, Ronald); van Tol, J (van Tol, Johan); Sherwin, MS (Sherwin, Mark S.); Awschalom, DD (Awschalom, David D.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 101 **Issue:** 4 **Article Number:** 047601 **DOI:** 10.1103/PhysRevLett.101.047601 **Published:** JUL 25 2008

Accession Number: WOS:000258427100057

PubMed ID: 18764365

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Takahashi, Susumu	K-2616-2014	0000-0002-1302-2845
Sherwin, Mark	Q-4762-2017	0000-0002-3869-1893
Hanson, Ronald	B-9555-2008	
van Tol, Johan	G-4190-2011	0000-0001-6972-2149

ISSN: 0031-9007

Record 69 of 107

Title: Coherent manipulation of single spins in semiconductors

Author(s): Hanson, R (Hanson, Ronald); Awschalom, DD (Awschalom, David D.)

Source: NATURE **Volume:** 453 **Issue:** 7198 **Pages:** 1043-1049 **DOI:** 10.1038/nature07129 **Published:** JUN 19 2008

Accession Number: WOS:000256839900046

PubMed ID: 18563155

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Hanson, Ronald	B-9555-2008	

ISSN: 0028-0836

Record 70 of 107

Title: Spin dynamics in a double quantum dot: Exact diagonalization study

Author(s): Sarkka, J (Sarkka, J.); Harju, A (Harju, A.)

Source: PHYSICAL REVIEW B **Volume:** 77 **Issue:** 24 **Article Number:** 245315 **DOI:** 10.1103/PhysRevB.77.245315 **Published:** JUN 2008

Accession Number: WOS:000257289700074

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harju, Ari	C-2828-2009	0000-0002-2233-2896

ISSN: 1098-0121

Record 71 of 107

Title: Quantum dynamics in electron-nuclei coupled spin system in quantum dots: Bunching, revival, and quantum correlation in electron-spin measurements

Author(s): Cakir, O (Cakir, Ozguer); Takagahara, T (Takagahara, Toshihide)

Source: PHYSICAL REVIEW B **Volume:** 77 **Issue:** 11 **Article Number:** 115304 **DOI:** 10.1103/PhysRevB.77.115304 **Published:** MAR 2008

Accession Number: WOS:000254542800100

ISSN: 1098-0121

Record 72 of 107

Title: Exponential decay in a spin bath

Author(s): Coish, WA (Coish, W. A.); Fischer, J (Fischer, Jan); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 77 **Issue:** 12 **Article Number:** 125329 **DOI:** 10.1103/PhysRevB.77.125329 **Published:** MAR 2008

Accession Number: WOS:000254543000101

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coish, William	A-5521-2008	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 73 of 107

Title: Long-time electron spin storage via dynamical suppression of hyperfine-induced decoherence in a quantum dot

Author(s): Zhang, WX (Zhang, Wenxian); Konstantinidis, NP (Konstantinidis, N. P.); Dobrovitski, VV (Dobrovitski, V. V.); Harmon, BN (Harmon, B. N.); Santos, LF (Santos, Lea F.); Viola, L (Viola, Lorenza)

Source: PHYSICAL REVIEW B **Volume:** 77 **Issue:** 12 **Article Number:** 125336 **DOI:** 10.1103/PhysRevB.77.125336 **Published:** MAR 2008

Accession Number: WOS:000254543000108

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Santos, Lea	D-5332-2012	0000-0001-9400-2709
Zhang, Wenxian	A-4274-2010	

ISSN: 1098-0121

Record 74 of 107

Title: Dynamic nuclear polarization with single electron spins

Author(s): Petta, JR (Petta, J. R.); Taylor, JM (Taylor, J. M.); Johnson, AC (Johnson, A. C.); Yacoby, A (Yacoby, A.); Lukin, MD (Lukin, M. D.); Marcus, CM (Marcus, C. M.); Hanson, MP (Hanson, M. P.); Gossard, AC (Gossard, A. C.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 100 **Issue:** 6 **Article Number:** 067601 **DOI:** 10.1103/PhysRevLett.100.067601 **Published:** FEB 15 2008

Accession Number: WOS:000253238400073

PubMed ID: 18352516

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Marcus, Charles	M-4526-2014	0000-0003-2420-4692
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Petta, Jason	J-6663-2013	0000-0002-6416-0789
Johnson, Alex		0000-0003-4623-4147

ISSN: 0031-9007

Record 75 of 107

Title: Electrical control of spin relaxation in a quantum dot

Author(s): Amasha, S (Amasha, S.); MacLean, K (MacLean, K.); Radu, IP (Radu, Iuliana P.); Zumbuhl, DM (Zumbuehl, D. M.); Kastner, MA (Kastner, M. A.); Hanson, MP (Hanson, M. P.); Gossard, AC (Gossard, A. C.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 100 **Issue:** 4 **Article Number:** 046803 **DOI:** 10.1103/PhysRevLett.100.046803 **Published:** FEB 1 2008

Accession Number: WOS:000252863400075

PubMed ID: 18352316

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kastner, Marc	F-9520-2010	
Radu, Iuliana		0000-0002-7230-7218

ISSN: 0031-9007

Record 76 of 107

Title: Control of electron spin decoherence in mesoscopic nuclear spin baths

Author(s): Liu, RB (Liu, Ren-Bao); Yao, W (Yao, Wang); Sham, LJ (Sham, L. J.)

Source: INTERNATIONAL JOURNAL OF MODERN PHYSICS B **Volume:** 22 **Issue:** 1-2 **Pages:** 27-32 **DOI:** 10.1142/S0217979208046013 **Published:** JAN 20 2008

Accession Number: WOS:000252848700003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Liu, Ren-Bao	B-3729-2011	0000-0002-0620-2370
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Sham, Lu		0000-0001-5718-2077

ISSN: 0217-9792

Record 77 of 107

Title: Decoherence in solid-state qubits

Author(s): Chirolli, L (Chirolli, Luca); Burkard, G (Burkard, Guido)

Source: ADVANCES IN PHYSICS **Volume:** 57 **Issue:** 3 **Pages:** 225-285 **DOI:** 10.1080/00018730802218067 **Published:** 2008

Accession Number: WOS:000258610600001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Chirolli, Luca	B-8706-2012	0000-0002-8439-9949

ISSN: 0001-8732

Record 78 of 107

Title: OPTICAL PREPARATION OF NUCLEAR SPINS COUPLED TO A LOCALIZED ELECTRON SPIN

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Burkard, G (Burkard, Guido)

Edited by: Takayanagi H; Nitta J; Nakano H

Source: CONTROLLABLE QUANTUM STATES: MESOSCOPIC SUPERCONDUCTIVITY AND SPRINTRONICS **Pages:** 371-376 **DOI:** 10.1142/9789812814623_0059 **Published:** 2008

Accession Number: WOS:000264208200059

Conference Title: 4th International Symposium on Mesoscopic Superconductivity and Spintronics

Conference Date: FEB 27-MAR 02, 2006

Conference Location: NTT, Atsugi, JAPAN

Conference Sponsors: Japan Sci & Technol Acgy, NTT Basic Res Labs

Conference Host: NTT

ISBN: 978-981-281-461-6

Record 79 of 107

Title: Magnetic ordering of nuclear spins in an interacting two-dimensional electron gas

Author(s): Simon, P (Simon, Pascal); Braunecker, B (Braunecker, Bernd); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 77 **Issue:** 4 **Article Number:** 045108 **DOI:** 10.1103/PhysRevB.77.045108 **Published:** JAN 2008

Accession Number: WOS:000252863100027

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 80 of 107

Title: Spin dynamics in InAs nanowire quantum dots coupled to a transmission line

Author(s): Trif, M (Trif, Mircea); Golovach, VN (Golovach, Vitaly N.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 77 **Issue:** 4 **Article Number:** 045434 **DOI:** 10.1103/PhysRevB.77.045434 **Published:** JAN 2008

Accession Number: WOS:000252863100136

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Trif, Mircea	A-6703-2010	
Golovach, Vitaly	B-6178-2014	0000-0001-7457-171X

ISSN: 1098-0121

Record 81 of 107

Title: Magnetic Ordering of Nuclear Spins in an Interacting 2D Electron Gas as a Consequence of Non-Analyticities in the 2D Fermi Liquid

Author(s): Simon, P (Simon, Pascal); Braunecker, B (Braunecker, Bernd); Loss, D (Loss, Daniel)

Source: PROGRESS OF THEORETICAL PHYSICS SUPPLEMENT **Issue:** 176 **Pages:** 302-321 **DOI:** 10.1143/PTPS.176.302 **Published:** 2008

Accession Number: WOS:000263348100017

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0375-9687

Record 82 of 107

Title: Magnetic Order in Kondo-Lattice Systems due to Electron-Electron Interactions

Author(s): Braunecker, B (Braunecker, Bernd); Simon, P (Simon, Pascal); Loss, D (Loss, Daniel)

Edited by: Goan HS; Chen YN

Source: SOLID-STATE QUANTUM COMPUTING, PROCEEDINGS **Book Series:** AIP Conference Proceedings **Volume:** 1074 **Pages:** 62-67 **Published:** 2008

Accession Number: WOS:000262361800013

Conference Title: 2nd International Workshop on Solid-State Quantum Computing/Mini-School on Quantum Information Science

Conference Date: JUN 23-27, 2008

Conference Location: Taipei, TAIWAN

Conference Sponsors: Natl Sci Council, Natl Ctr Theoret Sci S, Natl Ctr Theoret Sci N, Acad Sinica, Res Ctr Appl Sci, Natl Cheng Kung Univ, Ctr Theoret Sci, Natl Taiwan Univ, Dept Phys, Natl Taiwan Univ, Coll Sci

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0094-243X

ISBN: 978-0-7354-0605-6

Record 83 of 107

Title: Electrically driven reverse overhauser pumping of nuclear spins in quantum dots

Author(s): Rudner, MS (Rudner, M. S.); Levitov, LS (Levitov, L. S.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 99 **Issue:** 24 **Article Number:** 246602 **DOI:** 10.1103/PhysRevLett.99.246602 **Published:** DEC 14 2007

Accession Number: WOS:000251674300045

PubMed ID: 18233468

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rudner, Mark	C-9325-2015	0000-0002-5150-6234
Levitov, Leonid		0000-0002-4268-731X

ISSN: 0031-9007

Record 84 of 107

Title: Quantum dynamics of electron-nuclei coupled system in quantum dots

Author(s): Cakir, O (Cakir, Oezguer); Takagahara, T (Takagahara, Toshihide)

Source: PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES **Volume:** 40 **Issue:** 2 **Pages:** 379-382 **DOI:** 10.1016/j.physe.2007.06.026 **Published:** DEC 2007

Accession Number: WOS:000251886200041

Conference Title: 2nd International Symposium on Nanometer-Scale Quantum Physics

Conference Date: JAN 24-26, 2007

Conference Location: Tokyo Inst Technol, Tokyo, JAPAN

Conference Sponsors: Minist Educ, Culture, Sports, Sci & Technol, Tokyo Tech Res Ctr, Physical Soc Japan, Japan Soc Appl Phys

Conference Host: Tokyo Inst Technol

ISSN: 1386-9477

Record 85 of 107

Title: Observation of extremely slow hole spin relaxation in self-assembled quantum dots

Author(s): Heiss, D (Heiss, D.); Schaeck, S (Schaeck, S.); Huebl, H (Huebl, H.); Bichler, M (Bichler, M.); Abstreiter, G (Abstreiter, G.); Finley, JJ (Finley, J. J.); Bulaev, DV (Bulaev, D. V.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 76 **Issue:** 24 **Article Number:** 241306 **DOI:** 10.1103/PhysRevB.76.241306 **Published:** DEC 2007

Accession Number: WOS:000251986600011

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Huebl, Hans	B-2485-2017	0000-0003-3023-5209
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Heiss, Dominik	C-6319-2008	0000-0002-8047-0699
Finley, Jonathan	L-4164-2015	0000-0003-3036-529X

ISSN: 1098-0121

Record 86 of 107

Title: Exactly solvable spin dynamics of an electron coupled to a large number of nuclei; the electron-nuclear spin echo in a quantum dot

Author(s): Kozlov, GG (Kozlov, G. G.)

Source: JOURNAL OF EXPERIMENTAL AND THEORETICAL PHYSICS **Volume:** 105 **Issue:** 4 **Pages:** 803-815 **DOI:** 10.1134/S1063776107100159 **Published:** OCT 2007

Accession Number: WOS:000251019500015

ISSN: 1063-7761

Record 87 of 107

Title: Spins in few-electron quantum dots

Author(s): Hanson, R (Hanson, R.); Kouwenhoven, LP (Kouwenhoven, L. P.); Petta, JR (Petta, J. R.); Tarucha, S (Tarucha, S.); Vandersypen, LMK (Vandersypen, L. M. K.)

Source: REVIEWS OF MODERN PHYSICS **Volume:** 79 **Issue:** 4 **Pages:** 1217-1265 **DOI:** 10.1103/RevModPhys.79.1217 **Published:** OCT-DEC 2007

Accession Number: WOS:000251107800003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Petta, Jason	J-6663-2013	0000-0002-6416-0789
TARUCHA, SEIGO	I-7030-2012	
Hanson, Ronald	B-9555-2008	

ISSN: 0034-6861

Record 88 of 107

Title: Control of electron spin decoherence caused by electron-nuclear spin dynamics in a quantum dot

Author(s): Liu, RB (Liu, Ren-Bao); Yao, W (Yao, Wang); Sham, LJ (Sham, L. J.)

Source: NEW JOURNAL OF PHYSICS **Volume:** 9 **Article Number:** 226 **DOI:** 10.1088/1367-2630/9/7/226 **Published:** JUL 11 2007

Accession Number: WOS:000247953300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Liu, Ren-Bao	B-3729-2011	0000-0002-0620-2370
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Sham, Lu		0000-0001-5718-2077

ISSN: 1367-2630

Record 89 of 107

Title: Dynamical control of electron spin coherence in a quantum dot: A theoretical study

Author(s): Zhang, WX (Zhang, Wenxian); Dobrovitski, VV (Dobrovitski, V. V.); Santos, LF (Santos, Lea F.); Viola, L (Viola, Lorenza); Harmon, BN (Harmon, B. N.)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 20 **Article Number:** 201302 **DOI:** 10.1103/PhysRevB.75.201302 **Published:** MAY 2007

Accession Number: WOS:000246890900005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zhang, Wenxian	A-4274-2010	
Santos, Lea	D-5332-2012	0000-0001-9400-2709

ISSN: 1098-0121

Record 90 of 107

Title: Quantum description of nuclear spin cooling in a quantum dot

Author(s): Christ, H (Christ, H.); Cirac, JI (Cirac, J. I.); Giedke, G (Giedke, G.)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 15 **Article Number:** 155324 **DOI:** 10.1103/PhysRevB.75.155324 **Published:** APR 2007

Accession Number: WOS:000246075300084

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cirac, Ignacio	A-9105-2017	0000-0003-3359-1743
Giedke, Geza		0000-0002-9676-5686

ISSN: 1098-0121

Record 91 of 107

Title: Dynamical nuclear spin polarization and the Zamboni effect in gated double quantum dots

Author(s): Ramon, G (Ramon, Guy); Hu, XD (Hu, Xuedong)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 16 **Article Number:** 161301 **DOI:** 10.1103/PhysRevB.75.161301 **Published:** APR 2007

Accession Number: WOS:000246075900005

ISSN: 1098-0121

Record 92 of 107

Title: Electric dipole spin resonance for heavy holes in quantum dots

Author(s): Bulaev, DV (Bulaev, Denis V.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW LETTERS **Volume:** 98 **Issue:** 9 **Article Number:** 097202 **DOI:** 10.1103/PhysRevLett.98.097202 **Published:** MAR 2 2007

Accession Number: WOS:000244592100052

PubMed ID: 17359191

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0031-9007

Record 93 of 107

Title: Nonequilibrium thermal entanglement

Author(s): Quiroga, L (Quiroga, Luis); Rodriguez, FJ (Rodriguez, Ferney J.); Ramirez, ME (Ramirez, Maria E.); Paris, R (Paris, Roberto)

Source: PHYSICAL REVIEW A **Volume:** 75 **Issue:** 3 **Article Number:** 032308 **DOI:** 10.1103/PhysRevA.75.032308 **Published:** MAR 2007

Accession Number: WOS:000245326300040

ISSN: 1050-2947

Record 94 of 107

Title: Single-electron spin decoherence by nuclear spin bath: Linked-cluster expansion approach

Author(s): Saikin, SK (Saikin, S. K.); Yao, W (Yao, Wang); Sham, LJ (Sham, L. J.)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 12 **Article Number:** 125314 **DOI:** 10.1103/PhysRevB.75.125314 **Published:** MAR 2007

Accession Number: WOS:000245330200063

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Saikin, Semion	A-3989-2010	0000-0003-1924-3961
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Sham, Lu		0000-0001-5718-2077

ISSN: 1098-0121

Record 95 of 107

Title: Modelling decoherence in quantum spin systems

Author(s): Zhang, WX (Zhang, Wenxian); Konstantinidis, N (Konstantinidis, N.); Al-Hassanieh, KA (Al-Hassanieh, K. A.); Dobrovitski, VV (Dobrovitski, V. V.)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 19 **Issue:** 8 **Article Number:** 083202 **DOI:** 10.1088/0953-8984/19/8/083202 **Published:** FEB 28 2007

Accession Number: WOS:000244166100004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zhang, Wenxian	A-4274-2010	

ISSN: 0953-8984

eISSN: 1361-648X

Record 96 of 107

Title: Restoring coherence lost to a slow interacting mesoscopic spin bath

Author(s): Yao, W (Yao, Wang); Liu, RB (Liu, Ren-Bao); Sham, LJ (Sham, L. J.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 98 **Issue:** 7 **Article Number:** 077602 **DOI:** 10.1103/PhysRevLett.98.077602 **Published:** FEB 16 2007

Accession Number: WOS:000244250300063

PubMed ID: 17359060

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yao, Wang	C-1353-2008	0000-0003-2883-4528
Liu, Ren-Bao	B-3729-2011	0000-0002-0620-2370
Sham, Lu		0000-0001-5718-2077

ISSN: 0031-9007

Record 97 of 107

Title: Universal set of quantum gates for double-dot spin qubits with fixed interdot coupling

Author(s): Hanson, R (Hanson, Ronald); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW LETTERS **Volume:** 98 **Issue:** 5 **Article Number:** 050502 **DOI:** 10.1103/PhysRevLett.98.050502 **Published:** FEB 2 2007

Accession Number: WOS:000244646100009

PubMed ID: 17358835

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Hanson, Ronald	B-9555-2008	

ISSN: 0031-9007

Record 98 of 107

Title: Quantum gates between capacitively coupled double quantum dot two-spin qubits

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 8 **Article Number:** 085324 **DOI:** 10.1103/PhysRevB.75.085324 **Published:** FEB 2007

Accession Number: WOS:000244533800054

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 1098-0121

Record 99 of 107

Title: Suppression of electron spin decoherence in a quantum dot

Author(s): Zhang, WX (Zhang, Wenxian); Dobrovitski, VV (Dobrovitski, V. V.); Santos, LF (Santos, Lea F.); Viola, L (Viola, Lorenza); Harmon, BN (Harmon, B. N.)

Source: JOURNAL OF MODERN OPTICS **Volume:** 54 **Issue:** 16-17 **Pages:** 2629-2640 **DOI:** 10.1080/09500340701534857 **Published:** 2007

Accession Number: WOS:000251361300032

Conference Title: 37th Winter Colloquium on the Physics of Quantum Electronics

Conference Date: JAN 02-06, 2007

Conference Location: Snowbird, UT

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Santos, Lea	D-5332-2012	0000-0001-9400-2709
Zhang, Wenxian	A-4274-2010	

ISSN: 0950-0340

Record 100 of 107

Title: Theoretical aspects of quantum state transfer, correlation measurement and electron-nuclei coupled dynamics in quantum dots

Author(s): Takagahara, T (Takagahara, Toshihide); Cakir, O (Cakir, Oezguer)

Source: JOURNAL OF NANOPHOTONICS **Volume:** 1 **Article Number:** 011593 **DOI:** 10.1117/1.2828099 **Published:** 2007

Accession Number: WOS:000261665400047

ISSN: 1934-2608

Record 101 of 107

Title: Coherent population trapping in a single-hole-charged quantum dot

Author(s): Imamoglu, A (Imamoglu, A.)

Source: PHYSICA STATUS SOLIDI B-BASIC SOLID STATE PHYSICS **Volume:** 243 **Issue:** 14 **Pages:** 3725-3729 **DOI:** 10.1002/pssb.200642282 **Published:** NOV 2006

Accession Number: WOS:000242536200020

ISSN: 0370-1972

Record 102 of 107

Title: Electron spin and nuclear spin manipulation in semiconductor nanosystems

Author(s): Hirayama, Y (Hirayama, Yoshiro); Yusa, G (Yusa, Go); Sasaki, S (Sasaki, Satoshi)

Source: PHYSICA STATUS SOLIDI B-BASIC SOLID STATE PHYSICS **Volume:** 243 **Issue:** 14 **Pages:** 3764-3772 **DOI:** 10.1002/pssb.200642259 **Published:** NOV 2006

Accession Number: WOS:000242536200024

ISSN: 0370-1972

Record 103 of 107

Title: Hyperfine interaction induced decoherence of electron spins in quantum dots

Author(s): Zhang, WX (Zhang, Wenxian); Dobrovitski, VV (Dobrovitski, V. V.); Al-Hassanieh, KA (Al-Hassanieh, K. A.); Dagotto, E (Dagotto, E.); Harmon, BN (Harmon, B. N.)

Source: PHYSICAL REVIEW B **Volume:** 74 **Issue:** 20 **Article Number:** 205313 **DOI:** 10.1103/PhysRevB.74.205313 **Published:** NOV 2006

Accession Number: WOS:000242409400057

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zhang, Wenxian	A-4274-2010	

ISSN: 1098-0121

Record 104 of 107

Title: Quantum physics - A spin solo

Author(s): Burkard, G (Burkard, Guido)

Source: NATURE **Volume:** 442 **Issue:** 7104 **Pages:** 749-750 **DOI:** 10.1038/442749a **Published:** AUG 17 2006

Accession Number: WOS:000239792700026

PubMed ID: 16915271

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 0028-0836

Record 105 of 107

Title: Driven coherent oscillations of a single electron spin in a quantum dot

Author(s): Koppens, FHL (Koppens, F. H. L.); Buizert, C (Buizert, C.); Tielrooij, KJ (Tielrooij, K. J.); Vink, IT (Vink, I. T.); Nowack, KC (Nowack, K. C.); Meunier, T (Meunier, T.); Kouwenhoven, LP (Kouwenhoven, L. P.); Vandersypen, LMK (Vandersypen, L. M. K.)

Source: NATURE **Volume:** 442 **Issue:** 7104 **Pages:** 766-771 **DOI:** 10.1038/nature05065 **Published:** AUG 17 2006

Accession Number: WOS:000239792700036

PubMed ID: 16915280

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Koppens, Frank		0000-0001-9764-6120
Buizert, Christo		0000-0002-2227-1747

ISSN: 0028-0836

Record 106 of 107

Title: Nuclear spin state narrowing via gate-controlled Rabi oscillations in a double quantum dot

Author(s): Klauser, D (Klauser, D.); Coish, WA (Coish, W. A.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 73 **Issue:** 20 **Article Number:** 205302 **DOI:** 10.1103/PhysRevB.73.205302 **Published:** MAY 2006

Accession Number: WOS:000237950500038

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coish, William	A-5521-2008	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

eISSN: 1550-235X

Record 107 of 107

Title: Knight-field-enabled nuclear spin polarization in single quantum dots

Author(s): Lai, CW (Lai, CW); Maletinsky, P (Maletinsky, P); Badolato, A (Badolato, A); Imamoglu, A (Imamoglu, A)

Source: PHYSICAL REVIEW LETTERS **Volume:** 96 **Issue:** 16 **Article Number:** 167403 **DOI:** 10.1103/PhysRevLett.96.167403 **Published:** APR 28 2006

Accession Number: WOS:000237156700070

PubMed ID: 16712275

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Maletinsky, Patrick	L-1851-2015	0000-0003-1699-388X
Badolato, Antonio	E-9778-2015	
Lai, Chih Wei	E-4945-2010	0000-0003-3571-4671

ISSN: 0031-9007

eISSN: 1079-7114

Record 1 of 61

Title: Leakage and sweet spots in triple-quantum-dot spin qubits: A molecular-orbital study

Author(s): Zhang, CX (Zhang, Chengxian); Yang, XC (Yang, Xu-Chen); Wang, X (Wang, Xin)

Source: PHYSICAL REVIEW A **Volume:** 97 **Issue:** 4 **Article Number:** 042326 **DOI:** 10.1103/PhysRevA.97.042326 **Published:** APR 16 2018

Accession Number: WOS:000430054000003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yang, Xu-Chen	O-3405-2017	0000-0001-5058-8496

ISSN: 2469-9926

eISSN: 2469-9934

Record 2 of 61

Title: Symmetric spin-orbit interaction in triple quantum dot and minimisation of spin-orbit leakage in CNOT gate

Author(s): Milivojevic, M (Milivojevic, Marko)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 30 **Issue:** 8 **Article Number:** 085302 **DOI:** 10.1088/1361-648X/aaa736 **Published:** FEB 28 2018

Accession Number: WOS:000424236800001

PubMed ID: 29328053

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Milivojevic, Marko		0000-0002-9583-3640

ISSN: 0953-8984

eISSN: 1361-648X

Record 3 of 61

Title: Ultracoherent operation of spin qubits with superexchange coupling

Author(s): Rancic, MJ (Rancic, Marko J.); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 96 **Issue:** 20 **Article Number:** 201304 **DOI:** 10.1103/PhysRevB.96.201304 **Published:** NOV 7 2017

Accession Number: WOS:000414529300001

ISSN: 2469-9950

eISSN: 2469-9969

Record 4 of 61

Title: Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin-orbit interaction

Author(s): Milivojevic, M (Milivojevic, Marko); Stepanenko, D (Stepanenko, Dimitrije)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 29 **Issue:** 40 **Article Number:** 405302 **DOI:** 10.1088/1361-648X/aa7f86 **Published:** OCT 11 2017

Accession Number: WOS:000425258500001

PubMed ID: 28703716

ISSN: 0953-8984

eISSN: 1361-648X

Record 5 of 61

Title: Robust quantum state transfer inspired by Dzyaloshinskii-Moriya interactions

Author(s): Shi, X (Shi, X.); Yuan, H (Yuan, H.); Mao, X (Mao, X.); Ma, Y (Ma, Y.); Zhao, HQ (Zhao, H. Q.)

Source: PHYSICAL REVIEW A **Volume:** 95 **Issue:** 5 **Article Number:** 052332 **DOI:** 10.1103/PhysRevA.95.052332 **Published:** MAY 16 2017

Accession Number: WOS:000401444200004

ISSN: 2469-9926

eISSN: 2469-9934

Record 6 of 61

Title: Coherent-state spin qubits in the presence of spin-orbit coupling

Author(s): Owen, ET (Owen, E. T.); Dean, MC (Dean, M. C.); Barnes, CHW (Barnes, C. H. W.)

Source: PHYSICAL REVIEW A **Volume:** 89 **Issue:** 3 **Article Number:** 032305 **DOI:** 10.1103/PhysRevA.89.032305 **Published:** MAR 6 2014

Accession Number: WOS:000332340800001

ISSN: 1050-2947

eISSN: 1094-1622

Record 7 of 61

Title: Spin-flip Raman scattering of the neutral and charged excitons confined in a CdTe/(Cd,Mg)Te quantum well

Author(s): Debus, J (Debus, J.); Dunker, D (Dunker, D.); Sapega, VF (Sapega, V. F.); Yakovlev, DR (Yakovlev, D. R.); Karczewski, G (Karczewski, G.); Wojtowicz, T (Wojtowicz, T.); Kossut, J (Kossut, J.); Bayer, M (Bayer, M.)

Source: PHYSICAL REVIEW B **Volume:** 87 **Issue:** 20 **Article Number:** 205316 **DOI:** 10.1103/PhysRevB.87.205316 **Published:** MAY 31 2013

Accession Number: WOS:000319803200008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wojtowicz, Tomasz	A-2887-2017	
Sapega, Victor	I-7983-2013	
Kossut, Jacek	K-9481-2016	0000-0001-6165-3169
Sapega, Victor		0000-0003-3944-7443
Yakovlev, Dmitri		0000-0001-7349-2745
Debus, Joerg		0000-0002-8678-4402

ISSN: 2469-9950

eISSN: 2469-9969

Record 8 of 61

Title: Alternative experimental protocol to demonstrate the Pusey-Barrett-Rudolph theorem

Author(s): Miller, DJ (Miller, D. J.)

Source: PHYSICAL REVIEW A **Volume:** 87 **Issue:** 1 **Article Number:** 014103 **DOI:** 10.1103/PhysRevA.87.014103 **Published:** JAN 16 2013

Accession Number: WOS:000313546100019

ISSN: 1050-2947

Record 9 of 61

Title: Prospects for Spin-Based Quantum Computing in Quantum Dots

Author(s): Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Edited by: Langer JS

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 4 **Book Series:** Annual Review of Condensed Matter Physics **Volume:** 4 **Pages:** 51-81 **DOI:** 10.1146/annurev-conmatphys-030212-184248 **Published:** 2013

Accession Number: WOS:000321694300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1947-5454

ISBN: 978-0-8243-5004-8

Record 10 of 61

Title: Exchange-based CNOT gates for singlet-triplet qubits with spin-orbit interaction

Author(s): Klinovaja, J (Klinovaja, Jelena); Stepanenko, D (Stepanenko, Dimitrije); Halperin, BI (Halperin, Bertrand I.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 8 **Article Number:** 085423 **DOI:** 10.1103/PhysRevB.86.085423 **Published:** AUG 13 2012

Accession Number: WOS:000307441900012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Klinovaja, Jelena	L-2510-2013	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 11 of 61

Title: Effect of the Dzyaloshinskii-Moriya interaction on heat conductivity in one-dimensional quantum Ising chains

Author(s): Li, W (Li, W.); Zhang, Z (Zhang, Z.); Tong, P (Tong, P.)

Source: EUROPEAN PHYSICAL JOURNAL B **Volume:** 85 **Issue:** 2 **Article Number:** 73 **DOI:** 10.1140/epjb/e2012-20798-6 **Published:** FEB 2012

Accession Number: WOS:000301430400014

ISSN: 1434-6028

Record 12 of 61

Title: TWO-IMPURITY KONDO MODEL: SPIN-ORBIT INTERACTIONS AND ENTANGLEMENT

Author(s): Johannesson, H (Johannesson, Henrik); Mross, DF (Mross, David F.); Eriksson, E (Eriksson, Erik)

Source: MODERN PHYSICS LETTERS B **Volume:** 25 **Issue:** 12-13 **Special Issue:** SI **Pages:** 1083-1091 **DOI:** 10.1142/S0217984911026796 **Published:** MAY 30 2011

Accession Number: WOS:000291169000023

Conference Title: International Conference on Frustrated Spin Systems, Cold Atoms and Nanomaterials

Conference Date: JUL 14-16, 2010

Conference Location: Hanoi, VIETNAM

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Eriksson, Erik	I-2954-2012	
Eriksson, Erik		0000-0001-5560-9743

ISSN: 0217-9849

Record 13 of 61

Title: Singlet-triplet avoided crossings and effective g factor versus spatial orientation of spin-orbit-coupled quantum dots

Author(s): Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.)

Source: PHYSICAL REVIEW B **Volume:** 83 **Issue:** 3 **Article Number:** 035315 **DOI:** 10.1103/PhysRevB.83.035315 **Published:** JAN 19 2011

Accession Number: WOS:000286768400010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
szafran, bartlomiej	A-1936-2017	
Nowak, Michal	F-8158-2013	
Szafran, Bartlomiej		0000-0001-6938-3247
Nowak, Michal		0000-0002-1877-2055

ISSN: 2469-9950

eISSN: 2469-9969

Record 14 of 61

Title: Time-dependent configuration-interaction simulations of spin swap in spin-orbit-coupled double quantum dots

Author(s): Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 16 **Article Number:** 165316 **DOI:** 10.1103/PhysRevB.82.165316 **Published:** OCT 12 2010

Accession Number: WOS:000282809500004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nowak, Michal	F-8158-2013	
szafran, bartlomiej	A-1936-2017	
Szafran, Bartlomiej		0000-0001-6938-3247
Nowak, Michal		0000-0002-1877-2055

ISSN: 2469-9950

eISSN: 2469-9969

Record 15 of 61

Title: Spin-orbit coupling and anisotropic exchange in two-electron double quantum dots

Author(s): Baruffa, F (Baruffa, Fabio); Stano, P (Stano, Peter); Fabian, J (Fabian, Jaroslav)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 4 **Article Number:** 045311 **DOI:** 10.1103/PhysRevB.82.045311 **Published:** JUL 21 2010

Accession Number: WOS:000280174200004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Stano, Peter	C-3016-2013	0000-0001-5835-0765
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525

ISSN: 1098-0121

Record 16 of 61

Title: Optimal control landscape for the generation of unitary transformations with constrained dynamics

Author(s): Hsieh, M (Hsieh, Michael); Wu, RB (Wu, Rebing); Rabitz, H (Rabitz, Herschel); Lidar, D (Lidar, Daniel)

Source: PHYSICAL REVIEW A **Volume:** 81 **Issue:** 6 **Article Number:** 062352 **DOI:** 10.1103/PhysRevA.81.062352 **Published:** JUN 30 2010

Accession Number: WOS:000279380300005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515
Wu, Rebing	A-3647-2013	0000-0003-3545-8700

ISSN: 2469-9926

eISSN: 2469-9934

Record 17 of 61

Title: Coupling of bonding and antibonding electron orbitals in double quantum dots by spin-orbit interaction

Author(s): Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.)

Source: PHYSICAL REVIEW B **Volume:** 81 **Issue:** 23 **Article Number:** 235311 **DOI:** 10.1103/PhysRevB.81.235311 **Published:** JUN 9 2010

Accession Number: WOS:000278555500010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nowak, Michal	F-8158-2013	
szafran, bartlomiej	A-1936-2017	
Nowak, Michal		0000-0002-1877-2055
Szafran, Bartlomiej		0000-0001-6938-3247

ISSN: 1098-0121

Record 18 of 61

Title: Berezinskii-Kosterlitz-Thouless transition uncovered by the fidelity susceptibility in the XXZ model

Author(s): Wang, B (Wang, Bo); Feng, M (Feng, Mang); Chen, ZQ (Chen, Ze-Qian)

Source: PHYSICAL REVIEW A **Volume:** 81 **Issue:** 6 **Article Number:** 064301 **DOI:** 10.1103/PhysRevA.81.064301 **Published:** JUN 2 2010

Accession Number: WOS:000278300400006

ISSN: 2469-9926

eISSN: 2469-9934

Record 19 of 61

Title: Concatenated cranking representation of the Schrodinger equation and resolution to pulsed quantum operations with spin exchange

Author(s): Ding, ZG (Ding, Zhi-Gang); Cen, LX (Cen, Li-Xiang); Wang, SJ (Wang, ShunJin)

Source: PHYSICAL REVIEW A **Volume:** 81 **Issue:** 3 **Article Number:** 032337 **DOI:** 10.1103/PhysRevA.81.032337 **Published:** MAR 2010

Accession Number: WOS:000276262500086

ISSN: 1050-2947

eISSN: 1094-1622

Record 20 of 61

Title: Quantum computing with electron spins in quantum dots

Author(s): Zak, RA (Zak, Robert Andrzej); Rothlisberger, B (Roethlisberger, Beat); Chesi, S (Chesi, Stefano); Loss, D (Loss, Daniel)

Source: RIVISTA DEL NUOVO CIMENTO **Volume:** 33 **Issue:** 7 **Pages:** 345-399 **DOI:** 10.1393/ncr/i2010-10056-y **Published:** 2010

Accession Number: WOS:000280505500001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0393-697X

eISSN: 1826-9850

Record 21 of 61

Title: Bloch sphere-like construction of SU(3) Hamiltonians using unitary integration

Author(s): Vinjanampathy, S (Vinjanampathy, Sai); Rau, ARP (Rau, A. R. P.)

Source: JOURNAL OF PHYSICS A-MATHEMATICAL AND THEORETICAL **Volume:** 42 **Issue:** 42 **Article Number:** 425303 **DOI:** 10.1088/1751-8113/42/42/425303 **Published:** OCT 23 2009

Accession Number: WOS:000270490500014

ISSN: 1751-8113

Record 22 of 61

Title: Selective suppression of Dresselhaus or Rashba spin-orbit coupling effects by the Zeeman interaction in quantum dots

Author(s): Szafran, B (Szafran, B.); Nowak, MP (Nowak, M. P.); Bednarek, S (Bednarek, S.); Chwiej, T (Chwiej, T.); Peeters, FM (Peeters, F. M.)

Source: PHYSICAL REVIEW B **Volume:** 79 **Issue:** 23 **Article Number:** 235303 **DOI:** 10.1103/PhysRevB.79.235303 **Published:** JUN 2009

Accession Number: WOS:000267699500073

Author Identifiers:

Author	ResearcherID Number	ORCID Number
szafran, bartlomiej	A-1936-2017	
Nowak, Michal	F-8158-2013	
CMT, UAntwerpen Group	A-5523-2016	
Nowak, Michal		0000-0002-1877-2055
Szafran, Bartlomiej		0000-0001-6938-3247

ISSN: 2469-9950

eISSN: 2469-9969

Record 23 of 61

Title: Influence of magnetic field on swap operation in Heisenberg XYZ model

Author(s): Liu, J (Liu, Jia); Zhang, GF (Zhang, Guo-Feng); Chen, ZY (Chen, Zi-Yu)

Source: PHYSICA B-CONDENSED MATTER **Volume:** 404 **Issue:** 8-11 **Pages:** 1116-1118 **DOI:** 10.1016/j.physb.2008.11.092 **Published:** MAY 1 2009

Accession Number: WOS:000265886100017

Author Identifiers:

Author	ResearcherID Number	ORCID Number
zhang, Guofeng	H-4991-2011	
Chen, Ziyu	P-1008-2016	0000-0002-3285-2457

ISSN: 0921-4526

Record 24 of 61

Title: Numerical study of a quantum dot structure for entanglement generation

Author(s): Giavaras, G (Giavaras, George)

Source: SEMICONDUCTOR SCIENCE AND TECHNOLOGY **Volume:** 23 **Issue:** 8 **Article Number:** 085010 **DOI:** 10.1088/0268-1242/23/10/085010 **Published:** AUG 2008

Accession Number: WOS:000257938100010

ISSN: 0268-1242

Record 25 of 61

Title: Effect of spin-orbit interaction on entanglement of two-qubit Heisenberg XYZ systems in an inhomogeneous magnetic field

Author(s): Kheirandish, F (Kheirandish, Fardin); Akhtarshenas, SJ (Akhtarshenas, S. Javad); Mohammadi, H (Mohammadi, Hamidreza)

Source: PHYSICAL REVIEW A **Volume:** 77 **Issue:** 4 **Article Number:** 042309 **DOI:** 10.1103/PhysRevA.77.042309 **Published:** APR 2008

Accession Number: WOS:000255457100046

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Akhtarshenas, Seyed Javad	F-5916-2017	0000-0002-9615-7816
Mohammadi, Hamidreza		0000-0001-7046-3818

ISSN: 1050-2947

Record 26 of 61

Title: Theory of spin qubits in nanostructures

Author(s): Trauzettel, B (Trauzettel, Bjoern); Borhani, M (Borhani, Massoud); Trif, M (Trif, Mircea); Loss, D (Loss, Daniel)

Source: JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN **Volume:** 77 **Issue:** 3 **Article Number:** 031012 **DOI:** 10.1143/JPSJ.77.031012 **Published:** MAR 2008

Accession Number: WOS:000254311900016

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trif, Mircea	A-6703-2010	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Trauzettel, Bjoern	C-4011-2017	0000-0002-7342-8425

ISSN: 0031-9015

Record 27 of 61

Title: Effect of the Dzyaloshinski-Moriya term in the quantum (SWAP)(alpha) gate produced with exchange coupling

Author(s): Guerrero, RJ (Guerrero, Roberto J.); Rojas, F (Rojas, F.)

Source: PHYSICAL REVIEW A **Volume:** 77 **Issue:** 1 **Article Number:** 012331 **DOI:** 10.1103/PhysRevA.77.012331 **Published:** JAN 2008

Accession Number: WOS:000252862000063

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rojas, Fernando	C-7775-2009	0000-0002-3893-1850

ISSN: 1050-2947

Record 28 of 61

Title: Mutual information and swap operation in the two-qubit Heisenberg model with Dzyaloshinskii-Moriya anisotropic antisymmetric interaction

Author(s): Zhang, GF (Zhang, Guo-Feng)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 19 **Issue:** 45 **Article Number:** 456205 **DOI:** 10.1088/0953-8984/19/45/456205 **Published:** NOV 14 2007

Accession Number: WOS:000250688700026

Author Identifiers:

Author	ResearcherID Number	ORCID Number
zhang, Guofeng	H-4991-2011	

ISSN: 0953-8984

Record 29 of 61

Title: Interplay between the Dzyaloshinskii-Moriya anisotropic antisymmetric interaction and the SWAP operation in a two-qubit Heisenberg model

Author(s): Zhang, GF (Zhang, Guo-Feng); Zhou, Y (Zhou, Yue)

Source: PHYSICS LETTERS A **Volume:** 370 **Issue:** 2 **Pages:** 136-138 **DOI:** 10.1016/j.physleta.2007.05.051 **Published:** OCT 15 2007

Accession Number: WOS:000250591600010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
zhang, Guofeng	H-4991-2011	

ISSN: 0375-9601

eISSN: 1873-2429

Record 30 of 61

Title: Quantum computation in semiconductor quantum dots of electron-spin asymmetric anisotropic exchange

Author(s): Hao, X (Hao, Xiang); Zhu, S (Zhu, Shiqun)

Source: PHYSICAL REVIEW A **Volume:** 76 **Issue:** 4 **Article Number:** 044306 **DOI:** 10.1103/PhysRevA.76.044306 **Published:** OCT 2007

Accession Number: WOS:000250619700224

ISSN: 1050-2947

Record 31 of 61

Title: Control and error prevention in condensed matter quantum computing devices

Author(s): Byrd, MS (Byrd, M. S.); Wu, LA (Wu, L. -A.)

Source: INTERNATIONAL JOURNAL OF MODERN PHYSICS B **Volume:** 21 **Issue:** 13-14 **Pages:** 2505-2516 **DOI:** 10.1142/S0217979207043841 **Published:** MAY 30 2007

Accession Number: WOS:000251989400041

Conference Title: 30th International Workshop on Condensed Matter Theories (CMT30)

Conference Date: JUN 05-10, 2006

Conference Location: Max-Planck Inst Phys Komplexer Syst, Dresden, GERMANY

Conference Host: Max-Planck Inst Phys Komplexer Syst

ISSN: 0217-9792

eISSN: 1793-6578

Record 32 of 61

Title: Quantum gates between capacitively coupled double quantum dot two-spin qubits

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 8 **Article Number:** 085324 **DOI:** 10.1103/PhysRevB.75.085324 **Published:** FEB 2007

Accession Number: WOS:000244533800054

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 1098-0121

Record 33 of 61

Title: Spin-spin coupling in electrostatically coupled quantum dots

Author(s): Trif, M (Trif, Mircea); Golovach, VN (Golovach, Vitaly N.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 8 **Article Number:** 085307 **DOI:** 10.1103/PhysRevB.75.085307 **Published:** FEB 2007

Accession Number: WOS:000244533800037

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trif, Mircea	A-6703-2010	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Golovach, Vitaly	B-6178-2014	0000-0001-7457-171X

ISSN: 2469-9950

eISSN: 2469-9969

Record 34 of 61

Title: Detection and measurement of the Dzyaloshinskii-Moriya interaction in double quantum dot systems

Author(s): Chutia, S (Chutia, Sucismita); Friesen, M (Friesen, Mark); Joynt, R (Joynt, Robert)

Source: PHYSICAL REVIEW B **Volume:** 73 **Issue:** 24 **Article Number:** 241304 **DOI:** 10.1103/PhysRevB.73.241304 **Published:** JUN 2006

Accession Number: WOS:000238696900005

ISSN: 1098-0121

Record 35 of 61

Title: Scheme for direct measurement of a general two-qubit Hamiltonian

Author(s): Devitt, SJ (Devitt, SJ); Cole, JH (Cole, JH); Hollenberg, LCL (Hollenberg, LCL)

Source: PHYSICAL REVIEW A **Volume:** 73 **Issue:** 5 **Article Number:** 052317 **DOI:** 10.1103/PhysRevA.73.052317 **Published:** MAY 2006

Accession Number: WOS:000237949300047

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cole, Jared	G-2992-2010	0000-0002-8943-6518
Hollenberg, Lloyd	B-2296-2010	
Devitt, Simon	C-3716-2008	0000-0002-5901-1391
HOLLENBERG, LLOYD		0000-0001-7672-6965

ISSN: 1050-2947

Record 36 of 61

Title: Quantum malware

Author(s): Wu, LA (Wu, Lian-Ao); Lidar, D (Lidar, Daniel)

Source: QUANTUM INFORMATION PROCESSING **Volume:** 5 **Issue:** 2 **Pages:** 69-81 **DOI:** 10.1007/s11128-006-0014-5 **Published:** APR 2006

Accession Number: WOS:000241550600001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 1570-0755

Record 37 of 61

Title: Design and control of spin gates in two quantum-dot arrays

Author(s): Usaj, G (Usaj, G); Balseiro, CA (Balseiro, CA)

Source: APPLIED PHYSICS LETTERS **Volume:** 88 **Issue:** 10 **Article Number:** 103103 **DOI:** 10.1063/1.2181275 **Published:** MAR 6 2006

Accession Number: WOS:000235905800061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Usaj, Gonzalo	E-6394-2010	0000-0002-3044-5778

ISSN: 0003-6951

eISSN: 1077-3118

Record 38 of 61

Title: Spin-based quantum dot quantum computing

Author(s): Hu, X (Hu, X)

Edited by: Fabian J; Fabian J; Hohenester U

Source: QUANTUM COHERENCE: FROM QUARKS TO SOLIDS **Book Series:** Lecture Notes in Physics **Volume:** 689 **Pages:** 83-114 **Published:** 2006

Accession Number: WOS:000236351800003

Conference Title: 42th Schladming Winter School on Quantum Coherence in Matter - From Quarks to Solids

Conference Date: FEB 28-MAR 06, 2004

Conference Location: Schladming, AUSTRIA

Conference Sponsors: Univ Graz, Div Theoret Phys

ISSN: 0075-8450

ISBN: 3-540-30085-6

Record 39 of 61

Title: Recipes for spin-based quantum computing

Author(s): Cerletti, V (Cerletti, V); Coish, WA (Coish, WA); Gywat, O (Gywat, O); Loss, D (Loss, D)

Source: NANOTECHNOLOGY **Volume:** 16 **Issue:** 4 **Pages:** R27-R49 **DOI:** 10.1088/0957-4484/16/4/R01 **Published:** APR 2005

Accession Number: WOS:000228949300009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coish, William	A-5521-2008	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0957-4484

eISSN: 1361-6528

Record 40 of 61

Title: Spin manipulation of free two-dimensional electrons in Si/SiGe quantum wells

Author(s): Tyryshkin, AM (Tyryshkin, AM); Lyon, SA (Lyon, SA); Jantsch, W (Jantsch, W); Schaffler, F (Schaffler, F)

Source: PHYSICAL REVIEW LETTERS **Volume:** 94 **Issue:** 12 **Article Number:** 126802 **DOI:** 10.1103/PhysRevLett.94.126802 **Published:** APR 1 2005

Accession Number: WOS:000228065600050

PubMed ID: 15903946

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schaffler, Friedrich	C-7026-2017	0000-0002-7093-2554
Tyryshkin, Alexei	A-5219-2008	

ISSN: 0031-9007

Record 41 of 61

Title: Exchange gate in solid-state spin-quantum computation: The applicability of the Heisenberg model

Author(s): Scarola, VW (Scarola, VW); Das Sarma, S (Das Sarma, S)

Source: PHYSICAL REVIEW A **Volume:** 71 **Issue:** 3 **Article Number:** 032340 **DOI:** 10.1103/PhysRevA.71.032340 **Part:** A **Published:** MAR 2005

Accession Number: WOS:000228632100055

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Scarola, Vito	G-5412-2012	0000-0002-8653-2723
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X

ISSN: 1050-2947

Record 42 of 61

Title: Thermal entanglement of spins in an inhomogeneous magnetic field

Author(s): Asoudeh, M (Asoudeh, M); Karimipour, V (Karimipour, V)

Source: PHYSICAL REVIEW A **Volume:** 71 **Issue:** 2 **Article Number:** 022308 **DOI:** 10.1103/PhysRevA.71.022308 **Published:** FEB 2005

Accession Number: WOS:000227483900032

ISSN: 1050-2947

eISSN: 1094-1622

Record 43 of 61

Title: Universal quantum computation through control of spin-orbit coupling

Author(s): Stepanenko, D (Stepanenko, D); Bonesteel, NE (Bonesteel, NE)

Source: PHYSICAL REVIEW LETTERS **Volume:** 93 **Issue:** 14 **Article Number:** 140501 **DOI:** 10.1103/PhysRevLett.93.140501 **Published:** OCT 1 2004

Accession Number: WOS:000224211900009

PubMed ID: 15524778

ISSN: 0031-9007

Record 44 of 61

Title: Quantum-cellular-automata pseudorandom maps

Author(s): Weinstein, YS (Weinstein, YS); Hellberg, CS (Hellberg, CS)

Source: PHYSICAL REVIEW A **Volume:** 69 **Issue:** 6 **Article Number:** 062301 **DOI:** 10.1103/PhysRevA.69.062301 **Published:** JUN 2004

Accession Number: WOS:000222471400019

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Weinstein, Yaakov	A-3513-2013	
Hellberg, C. Stephen	E-5391-2010	

ISSN: 2469-9926

eISSN: 2469-9934

Record 45 of 61

Title: Generation of entangled ancilla states for use in linear optics quantum computing

Author(s): Franson, JD (Franson, JD); Donegan, MM (Donegan, MM); Jacobs, BC (Jacobs, BC)

Source: PHYSICAL REVIEW A **Volume:** 69 **Issue:** 5 **Article Number:** 052328 **DOI:** 10.1103/PhysRevA.69.052328 **Published:** MAY 2004

Accession Number: WOS:000221813700066

ISSN: 1050-2947

Record 46 of 61

Title: Symmetry of anisotropic exchange interactions in semiconductor nanostructures

Author(s): Kavokin, KV (Kavokin, KV)

Source: PHYSICAL REVIEW B **Volume:** 69 **Issue:** 7 **Article Number:** 075302 **DOI:** 10.1103/PhysRevB.69.075302 **Published:** FEB 2004

Accession Number: WOS:000220055300061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kavokin, Kirill	I-7736-2013	0000-0002-0047-5706

ISSN: 1098-0121

Record 47 of 61

Title: Anisotropic transport in a two-dimensional electron gas in the presence of spin-orbit coupling

Author(s): Schliemann, J (Schliemann, J); Loss, D (Loss, D)

Source: PHYSICAL REVIEW B **Volume:** 68 **Issue:** 16 **Article Number:** 165311 **DOI:** 10.1103/PhysRevB.68.165311 **Published:** OCT 15 2003

Accession Number: WOS:000186571800042

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schliemann, John	D-4038-2013	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 48 of 61

Title: Implementing a Quantum Algorithm with Exchange-Coupled Quantum Dots: A Feasibility Study

Author(s): Myrgren, ES (Myrgren, E. S.); Whaley, KB (Whaley, K. B.)

Source: QUANTUM INFORMATION PROCESSING **Volume:** 2 **Issue:** 5 **Pages:** 309-345 **DOI:** 10.1023/B:QINP.0000022724.32019.7c **Published:** OCT 2003

Accession Number: WOS:000208502400001

ISSN: 1570-0755

Record 49 of 61

Title: Spin-orbit coupling and time-reversal symmetry in quantum gates

Author(s): Stepanenko, D (Stepanenko, D); Bonesteel, NE (Bonesteel, NE); DiVincenzo, DP (DiVincenzo, DP); Burkard, G (Burkard, G); Loss, D (Loss, D)

Source: PHYSICAL REVIEW B **Volume:** 68 **Issue:** 11 **Article Number:** 115306 **DOI:** 10.1103/PhysRevB.68.115306 **Published:** SEP 15 2003

Accession Number: WOS:000185829300058

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
DiVincenzo, David	H-5952-2013	0000-0003-4332-645X

ISSN: 1098-0121

Record 50 of 61

Title: Dressed qubits

Author(s): Wu, LA (Wu, LA); Lidar, DA (Lidar, DA)

Source: PHYSICAL REVIEW LETTERS **Volume:** 91 **Issue:** 9 **Article Number:** 097904 **DOI:** 10.1103/PhysRevLett.91.097904 **Published:** AUG 29 2003

Accession Number: WOS:000185235000051

PubMed ID: 14525212

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 0031-9007

Record 51 of 61

Title: Overview of spin-based quantum dot quantum computation

Author(s): Hu, XD (Hu, XD); Das Sarma, S (Das Sarma, S)

Source: PHYSICA STATUS SOLIDI B-BASIC SOLID STATE PHYSICS **Volume:** 238 **Issue:** 2 **Pages:** 360-365 **DOI:** 10.1002/pssb.200303094 **Published:** JUL 2003

Accession Number: WOS:000184299800032

Conference Title: 2nd International Conference on Semiconductor Quantum Dots

Conference Date: SEP 30-OCT 03, 2002

Conference Location: UNIV TOKYO, KOMABA CAMPUS, TOKYO, JAPAN

Conference Host: UNIV TOKYO, KOMABA CAMPUS

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X

ISSN: 0370-1972

eISSN: 1521-3951

Record 52 of 61

Title: Hydrogenic spin quantum computing in silicon: A digital approach

Author(s): Skinner, AJ (Skinner, AJ); Davenport, ME (Davenport, ME); Kane, BE (Kane, BE)

Source: PHYSICAL REVIEW LETTERS **Volume:** 90 **Issue:** 8 **Article Number:** 087901 **DOI:** 10.1103/PhysRevLett.90.087901 **Published:** FEB 28 2003

Accession Number: WOS:000181289300048

PubMed ID: 12633460

ISSN: 0031-9007

Record 53 of 61

Title: Universal quantum logic from Zeeman and anisotropic exchange interactions

Author(s): Wu, LA (Wu, LA); Lidar, DA (Lidar, DA)

Source: PHYSICAL REVIEW A **Volume:** 66 **Issue:** 6 **Article Number:** 062314 **DOI:** 10.1103/PhysRevA.66.062314 **Published:** DEC 2002

Accession Number: WOS:000180656800037

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 2469-9926

eISSN: 2469-9934

Record 54 of 61

Title: Magnetic anisotropy in the molecular complex V-15

Author(s): Konstantinidis, NP (Konstantinidis, NP); Coffey, D (Coffey, D)

Source: PHYSICAL REVIEW B **Volume:** 66 **Issue:** 17 **Article Number:** 174426 **DOI:** 10.1103/PhysRevB.66.174426 **Published:** NOV 1 2002

Accession Number: WOS:000179611700070

ISSN: 1098-0121

Record 55 of 61

Title: Effects of J-gate potential and uniform electric field on a coupled donor pair in Si for quantum computing

Author(s): Fang, AB (Fang, AB); Chang, YC (Chang, YC); Tucker, JR (Tucker, JR)

Source: PHYSICAL REVIEW B **Volume:** 66 **Issue:** 15 **Article Number:** 155331 **DOI:** 10.1103/PhysRevB.66.155331 **Published:** OCT 15 2002

Accession Number: WOS:000179080800110

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Chang, Yia-Chung	F-4239-2011	

ISSN: 2469-9950

eISSN: 2469-9969

Record 56 of 61

Title: Double-occupation errors induced by orbital dephasing in exchange-interaction quantum gates

Author(s): Barrett, SD (Barrett, SD); Barnes, CHW (Barnes, CHW)

Source: PHYSICAL REVIEW B **Volume:** 66 **Issue:** 12 **Article Number:** 125318 **DOI:** 10.1103/PhysRevB.66.125318 **Published:** SEP 15 2002

Accession Number: WOS:000178461100048

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Barrett, Sean	B-9751-2008	
Barnes, Crispin	B-6590-2009	

ISSN: 1098-0121

eISSN: 1550-235X

Record 57 of 61

Title: Qubits as parafermions

Author(s): Wu, LA (Wu, LA); Lidar, DA (Lidar, DA)

Source: JOURNAL OF MATHEMATICAL PHYSICS **Volume:** 43 **Issue:** 9 **Pages:** 4506-4525 **DOI:** 10.1063/1.1499208 **Published:** SEP 2002

Accession Number: WOS:000177556600020

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 0022-2488

Record 58 of 61

Title: Encoded universality for generalized anisotropic exchange Hamiltonians

Author(s): Vala, J (Vala, J); Whaley, KB (Whaley, KB)

Source: PHYSICAL REVIEW A **Volume:** 66 **Issue:** 2 **Article Number:** 022304 **DOI:** 10.1103/PhysRevA.66.022304 **Published:** AUG 2002

Accession Number: WOS:000177872600030

ISSN: 1050-2947

Record 59 of 61

Title: Comprehensive encoding and decoupling solution to problems of decoherence and design in solid-state quantum computing

Author(s): Byrd, MS (Byrd, MS); Lidar, DA (Lidar, DA)

Source: PHYSICAL REVIEW LETTERS **Volume:** 89 **Issue:** 4 **Article Number:** 047901 **DOI:** 10.1103/PhysRevLett.89.047901 **Published:** JUL 22 2002

Accession Number: WOS:000176768700031

PubMed ID: 12144500

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 0031-9007

Record 60 of 61

Title: Power of anisotropic exchange interactions: Universality and efficient codes for quantum computing

Author(s): Wu, LA (Wu, LA); Lidar, DA (Lidar, DA)

Source: PHYSICAL REVIEW A **Volume:** 65 **Issue:** 4 **Article Number:** 042318 **DOI:** 10.1103/PhysRevB.65.042318 **Part:** A **Published:** APR 2002

Accession Number: WOS:000174978600044

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 1050-2947

Record 61 of 61

Title: Cancellation of spin-orbit effects in quantum gates based on the exchange coupling in quantum dots

Author(s): Burkard, G (Burkard, G); Loss, D (Loss, D)

Source: PHYSICAL REVIEW LETTERS **Volume:** 88 **Issue:** 4 **Article Number:** 047903 **DOI:** 10.1103/PhysRevLett.88.047903 **Published:** JAN 28 2002

Accession Number: WOS:000173907500078

PubMed ID: 11801171

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0031-9007

Record 1 of 55

Title: Symmetric spin-orbit interaction in triple quantum dot and minimisation of spin-orbit leakage in CNOT gate

Author(s): Milivojevic, M (Milivojevic, Marko)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 30 **Issue:** 8 **Article Number:** 085302 **DOI:** 10.1088/1361-648X/aaa736 **Published:** FEB 28 2018

Accession Number: WOS:000424236800001

PubMed ID: 29328053

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Milivojevic, Marko		0000-0002-9583-3640

ISSN: 0953-8984

eISSN: 1361-648X

Record 2 of 55

Title: Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin-orbit interaction

Author(s): Milivojevic, M (Milivojevic, Marko); Stepanenko, D (Stepanenko, Dimitrije)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 29 **Issue:** 40 **Article Number:** 405302 **DOI:** 10.1088/1361-648X/aa7f86 **Published:** OCT 11 2017

Accession Number: WOS:000425258500001

PubMed ID: 28703716

ISSN: 0953-8984

eISSN: 1361-648X

Record 3 of 55

Title: Exact analysis of gate noise effects on non-adiabatic transformations of spin-orbit qubits

Author(s): Ulcakar, L (Ulcakar, Lara); Ramsak, A (Ramsak, Anton)

Source: NEW JOURNAL OF PHYSICS **Volume:** 19 **Article Number:** 093015 **DOI:** 10.1088/1367-2630/aa7faf **Published:** SEP 20 2017

Accession Number: WOS:000411451500003

ISSN: 1367-2630

Record 4 of 55

Title: Tunable spin-orbit-coupled Bose-Einstein condensates in deep optical lattices

Author(s): Salerno, M (Salerno, M.); Abdullaev, FK (Abdullaev, F. Kh.); Gammal, A (Gammal, A.); Tomio, L (Tomio, Lauro)

Source: PHYSICAL REVIEW A **Volume:** 94 **Issue:** 4 **Article Number:** 043602 **DOI:** 10.1103/PhysRevA.94.043602 **Published:** OCT 3 2016

Accession Number: WOS:000384468800012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Institute of Physics, USP	H-5191-2017	

ISSN: 2469-9926

eISSN: 2469-9934

Record 5 of 55

Title: Long-range spin-triplet correlations and edge spin currents in diffusive spin-orbit coupled SNS hybrids with a single spin-active interface

Author(s): Alidoust, M (Alidoust, Mohammad); Halterman, K (Halterman, Klaus)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 27 **Issue:** 23 **Article Number:** 235301 **DOI:** 10.1088/0953-8984/27/23/235301 **Published:** JUN 17 2015

Accession Number: WOS:000355254200015

PubMed ID: 25996592

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Alidoust, Mohammad	I-6296-2013	0000-0002-1554-687X
Halterman, Klaus		0000-0002-6355-3134

ISSN: 0953-8984

eISSN: 1361-648X

Record 6 of 55

Title: Spontaneous edge accumulation of spin currents in finite-size two-dimensional diffusive spin-orbit coupled SFS heterostructures

Author(s): Alidoust, M (Alidoust, Mohammad); Halterman, K (Halterman, Klaus)

Source: NEW JOURNAL OF PHYSICS **Volume:** 17 **Article Number:** 033001 **DOI:** 10.1088/1367-2630/17/3/033001 **Published:** MAR 3 2015

Accession Number: WOS:000352898500001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Alidoust, Mohammad	I-6296-2013	0000-0002-1554-687X
Halterman, Klaus		0000-0002-6355-3134

ISSN: 1367-2630

Record 7 of 55

Title: Spin-orbit effects on the nonlinear optical properties of a quantum dot in simultaneous electric and magnetic fields

Author(s): Aytekin, O (Aytekin, O.); Turgut, S (Turgut, S.); Tomak, M (Tomak, M.)

Source: PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES **Volume:** 64 **Pages:** 29-32 **DOI:** 10.1016/j.physe.2014.06.018 **Published:** NOV 2014

Accession Number: WOS:000342955800005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Turgut, Sadi	A-6589-2010	0000-0003-4575-8424

ISSN: 1386-9477

eISSN: 1873-1759

Record 8 of 55

Title: Generation and control of electronic hybrid entanglement via a two-dimensional Rashba anisotropic nanodot

Author(s): Amiri, F (Amiri, F.); Rastgoo, S (Rastgoo, S.); Golshan, MM (Golshan, M. M.)

Source: PHYSICS LETTERS A **Volume:** 378 **Issue:** 30-31 **Pages:** 1985-1991 **DOI:** 10.1016/j.physleta.2014.04.073 **Published:** JUN 13 2014

Accession Number: WOS:000339697600003

ISSN: 0375-9601

eISSN: 1873-2429

Record 9 of 55

Title: Precision control of charge coherence in parallel double dot systems through spin-orbit interaction

Author(s): Jin, JS (Jin, Jinshuang); Tu, MWY (Tu, Matisse Wei-Yuan); Wang, NE (Wang, Nien-En); Zhang, WM (Zhang, Wei-Min)

Source: JOURNAL OF CHEMICAL PHYSICS **Volume:** 139 **Issue:** 6 **Article Number:** 064706 **DOI:** 10.1063/1.4817850 **Published:** AUG 14 2013

Accession Number: WOS:000323177900043

PubMed ID: 23947879

Author Identifiers:

Author	ResearcherID Number	ORCID Number
ZHANG, Wei-Min	Q-3713-2016	0000-0003-2117-3608

ISSN: 0021-9606

Record 10 of 55

Title: Position-dependent temporal behavior of spin states in a Rashba-Dresselhaus nanoloop

Author(s): Safaiee, R (Safaiee, R.); Golshan, MM (Golshan, M. M.)

Source: SUPERLATTICES AND MICROSTRUCTURES **Volume:** 60 **Pages:** 192-200 **DOI:** 10.1016/j.spmi.2013.04.037 **Published:** AUG 2013

Accession Number: WOS:000322610100020

ISSN: 0749-6036

Record 11 of 55

Title: A non-adiabatically driven electron in a quantum wire with spin-orbit interaction

Author(s): Cadez, T (Cadez, T.); Jefferson, JH (Jefferson, J. H.); Ramsak, A (Ramsak, A.)

Source: NEW JOURNAL OF PHYSICS **Volume:** 15 **Article Number:** 013029 **DOI:** 10.1088/1367-2630/15/1/013029 **Published:** JAN 15 2013

Accession Number: WOS:000313616700004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cadez, Tilen	N-7397-2014	0000-0002-5343-4086

ISSN: 1367-2630

Record 12 of 55

Title: Resonant harmonic generation and collective spin rotations in electrically driven quantum dots

Author(s): Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.); Peeters, FM (Peeters, F. M.)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 12 **Article Number:** 125428 **DOI:** 10.1103/PhysRevB.86.125428 **Published:** SEP 18 2012

Accession Number: WOS:000308867300005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
CMT, UAntwerpen Group	A-5523-2016	
szafran, bartlomiej	A-1936-2017	
Nowak, Michal	F-8158-2013	
Szafran, Bartlomiej		0000-0001-6938-3247
Nowak, Michal		0000-0002-1877-2055

ISSN: 1098-0121

Record 13 of 55

Title: Spin manipulation and relaxation in spin-orbit qubits

Author(s): Borhani, M (Borhani, Massoud); Hu, XD (Hu, Xuedong)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 12 **Article Number:** 125132 **DOI:** 10.1103/PhysRevB.85.125132 **Published:** MAR 28 2012

Accession Number: WOS:000302004100002

ISSN: 1098-0121

Record 14 of 55

Title: Singlet-triplet splitting in double quantum dots due to spin-orbit and hyperfine interactions

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Rudner, M (Rudner, Mark); Halperin, BI (Halperin, Bertrand I.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 7 **Article Number:** 075416 **DOI:** 10.1103/PhysRevB.85.075416 **Published:** FEB 16 2012

Accession Number: WOS:000300419500002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rudner, Mark	C-9325-2015	0000-0002-5150-6234
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 15 of 55

Title: Configuration interaction calculations of the controlled phase gate in double quantum dot qubits

Author(s): Nielsen, E (Nielsen, Erik); Muller, RP (Muller, Richard P.); Carroll, MS (Carroll, Malcolm S.)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 3 **Article Number:** 035319 **DOI:** 10.1103/PhysRevB.85.035319 **Published:** JAN 25 2012

Accession Number: WOS:000299871000004

ISSN: 1098-0121

Record 16 of 55

Title: Single Electron's Dynamical Behavior in a Two Dimensional Anisotropic Quantum Dot with Account of Rashba Effect

Author(s): Sisakhti, M (Sisakhti, Masoumeh); Golshan, MM (Golshan, Mohammad Mehdi); Sanaee, M (Sanaee, Maryam)

Source: JOURNAL OF COMPUTATIONAL AND THEORETICAL NANOSCIENCE **Volume:** 8 **Issue:** 10 **Pages:** 2166-2171 **DOI:** 10.1166/jctn.2011.1939 **Published:** OCT 2011

Accession Number: WOS:000301081800040

ISSN: 1546-1955

Record 17 of 55

Title: Entanglement of electronic subbands and coherent superposition of spin states in a Rashba nanoloop

Author(s): Safaiee, R (Safaiee, R.); Golshan, MM (Golshan, M. M.)

Source: EUROPEAN PHYSICAL JOURNAL B **Volume:** 83 **Issue:** 4 **Pages:** 457-463 **DOI:** 10.1140/epjb/e2011-20142-x **Published:** OCT 2011

Accession Number: WOS:000296633700007

ISSN: 1434-6028

Record 18 of 55

Title: Spintronic properties of graphene films grown on Ni(111) substrate

Author(s): Gong, SJ (Gong, S. J.); Li, ZY (Li, Z. Y.); Yang, ZQ (Yang, Z. Q.); Gong, C (Gong, Cheng); Duan, CG (Duan, Chun-Gang); Chu, JH (Chu, J. H.)

Source: JOURNAL OF APPLIED PHYSICS **Volume:** 110 **Issue:** 4 **Article Number:** 043704 **DOI:** 10.1063/1.3622618 **Published:** AUG 15 2011

Accession Number: WOS:000294484300064

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Gong, Cheng	I-1981-2013	0000-0001-7714-6380
Duan, Chun-Gang	D-2755-2013	

ISSN: 0021-8979

eISSN: 1089-7550

Record 19 of 55

Title: Acoustically Induced Spin-Orbit Interactions Revealed by Two-Dimensional Imaging of Spin Transport in GaAs

Author(s): Sanada, H (Sanada, H.); Sogawa, T (Sogawa, T.); Gotoh, H (Gotoh, H.); Onomitsu, K (Onomitsu, K.); Kohda, M (Kohda, M.); Nitta, J (Nitta, J.); Santos, PV (Santos, P. V.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 106 **Issue:** 21 **Article Number:** 216602 **DOI:** 10.1103/PhysRevLett.106.216602 **Published:** MAY 26 2011

Accession Number: WOS:000291007200007

PubMed ID: 21699325

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Sanada, Haruki	B-4289-2009	
Kohda, Makoto	C-2347-2016	

ISSN: 0031-9007

Record 20 of 55

Title: Controllable Anisotropic Exchange Coupling between Spin Qubits in Quantum Dots

Author(s): Shim, YP (Shim, Yun-Pil); Oh, SC (Oh, Sangchul); Hu, XD (Hu, Xuedong); Friesen, M (Friesen, Mark)

Source: PHYSICAL REVIEW LETTERS **Volume:** 106 **Issue:** 18 **Article Number:** 180503 **DOI:** 10.1103/PhysRevLett.106.180503 **Published:** MAY 6 2011

Accession Number: WOS:000290304800003

PubMed ID: 21635075

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Oh, Sangchul	C-2374-2012	
Shim, Yun-Pil	C-6603-2012	0000-0002-5836-7847

ISSN: 0031-9007

eISSN: 1079-7114

Record 21 of 55

Title: Manipulation of two spin qubits in a double quantum dot using an electric field

Author(s): Shitade, A (Shitade, Atsuo); Ezawa, M (Ezawa, Motohiko); Nagaosa, N (Nagaosa, Naoto)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 19 **Article Number:** 195305 **DOI:** 10.1103/PhysRevB.82.195305 **Published:** NOV 4 2010

Accession Number: WOS:000283839800004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Shitade, Atsuo	B-7980-2015	
Nagaosa, Naoto	G-7057-2012	
Ezawa, Motohiko	I-4671-2016	0000-0002-3629-5643

ISSN: 1098-0121

Record 22 of 55

Title: Suppression of Kondo-assisted cotunneling in a spin-1 quantum dot with spin-orbit interaction

Author(s): Lucignano, P (Lucignano, Procolo); Fabrizio, M (Fabrizio, Michele); Tagliacozzo, A (Tagliacozzo, Arturo)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 16 **Article Number:** 161306 **DOI:** 10.1103/PhysRevB.82.161306 **Published:** OCT 18 2010

Accession Number: WOS:000283051000001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
fabrizio, michele	N-3762-2014	0000-0002-2943-3278
LUCIGNANO, PROCOLO		0000-0003-2784-8485

ISSN: 1098-0121

Record 23 of 55

Title: Time-dependent configuration-interaction simulations of spin swap in spin-orbit-coupled double quantum dots

Author(s): Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 16 **Article Number:** 165316 **DOI:** 10.1103/PhysRevB.82.165316 **Published:** OCT 12 2010

Accession Number: WOS:000282809500004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nowak, Michal	F-8158-2013	
szafran, bartlomiej	A-1936-2017	
Szafran, Bartlomiej		0000-0001-6938-3247
Nowak, Michal		0000-0002-1877-2055

ISSN: 2469-9950

eISSN: 2469-9969

Record 24 of 55

Title: Exchange cotunneling through quantum dots with spin-orbit coupling

Author(s): Paaske, J (Paaske, J.); Andersen, A (Andersen, A.); Flensberg, K (Flensberg, K.)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 8 **Article Number:** 081309 **DOI:** 10.1103/PhysRevB.82.081309 **Published:** AUG 31 2010

Accession Number: WOS:000281406100001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Paaske, Jens	O-8273-2014	0000-0002-8087-591X
Flensberg, Karsten	N-4718-2014	0000-0002-8311-0103

ISSN: 1098-0121

Record 25 of 55

Title: Spin-orbit coupling and anisotropic exchange in two-electron double quantum dots

Author(s): Baruffa, F (Baruffa, Fabio); Stano, P (Stano, Peter); Fabian, J (Fabian, Jaroslav)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 4 **Article Number:** 045311 **DOI:** 10.1103/PhysRevB.82.045311 **Published:** JUL 21 2010

Accession Number: WOS:000280174200004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Stano, Peter	C-3016-2013	0000-0001-5835-0765
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525

ISSN: 1098-0121

Record 26 of 55

Title: Coupling of bonding and antibonding electron orbitals in double quantum dots by spin-orbit interaction

Author(s): Nowak, MP (Nowak, M. P.); Szafran, B (Szafran, B.)

Source: PHYSICAL REVIEW B **Volume:** 81 **Issue:** 23 **Article Number:** 235311 **DOI:** 10.1103/PhysRevB.81.235311 **Published:** JUN 9 2010

Accession Number: WOS:000278555500010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nowak, Michal	F-8158-2013	
szafran, bartlomiej	A-1936-2017	
Nowak, Michal		0000-0002-1877-2055
Szafran, Bartlomiej		0000-0001-6938-3247

ISSN: 1098-0121

Record 27 of 55

Title: Theory of Anisotropic Exchange in Laterally Coupled Quantum Dots

Author(s): Baruffa, F (Baruffa, Fabio); Stano, P (Stano, Peter); Fabian, J (Fabian, Jaroslav)

Source: PHYSICAL REVIEW LETTERS **Volume:** 104 **Issue:** 12 **Article Number:** 126401 **DOI:** 10.1103/PhysRevLett.104.126401 **Published:** MAR 26 2010

Accession Number: WOS:000276072400036

PubMed ID: 20366552

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Stano, Peter	C-3016-2013	0000-0001-5835-0765
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525

ISSN: 0031-9007

Record 28 of 55

Title: Quantum kinetic equation for spin relaxation and spin Hall effect in GaAs

Author(s): Lee, HC (Lee, H. C.); Mou, CY (Mou, C. -Y.)

Source: EUROPEAN PHYSICAL JOURNAL B **Volume:** 73 **Issue:** 2 **Pages:** 229-242 **DOI:** 10.1140/epjb/e2009-00437-3 **Published:** JAN 2010

Accession Number: WOS:000274253100011

ISSN: 1434-6028

Record 29 of 55

Title: Biexciton in magnetic fields

Author(s): Varga, K (Varga, Kalman)

Source: FEW-BODY SYSTEMS **Volume:** 47 **Issue:** 1-2 **Pages:** 65-71 **DOI:** 10.1007/s00601-009-0062-3 **Published:** JAN 2010

Accession Number: WOS:000273446000007

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Varga, Kalman	A-7102-2013	

ISSN: 0177-7963

Record 30 of 55

Title: Quantum computing with electron spins in quantum dots

Author(s): Zak, RA (Zak, Robert Andrzej); Rothlisberger, B (Roethlisberger, Beat); Chesi, S (Chesi, Stefano); Loss, D (Loss, Daniel)

Source: RIVISTA DEL NUOVO CIMENTO **Volume:** 33 **Issue:** 7 **Pages:** 345-399 **DOI:** 10.1393/ncr/i2010-10056-y **Published:** 2010

Accession Number: WOS:000280505500001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0393-697X

eISSN: 1826-9850

Record 31 of 55

Title: Temporal behavior of entanglement between electronic spin and subband states in a Rashba nanoloop

Author(s): Safaiee, R (Safaiee, R.); Golshan, MM (Golshan, M. M.); Foroozani, N (Foroozani, N.)

Source: JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT **Article Number:** P11014 **DOI:** 10.1088/1742-5468/2009/11/P11014 **Published:** NOV 2009

Accession Number: WOS:000274266100002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Foroozani, Neda	H-2720-2013	

ISSN: 1742-5468

Record 32 of 55

Title: Spin Precession in a Quasi-1D Rashba Quantum Loop

Author(s): Golshan, MM (Golshan, M. M.); Safaiee, R (Safaiee, R.); Foroozani, N (Foroozani, N.)

Source: JOURNAL OF COMPUTATIONAL AND THEORETICAL NANOSCIENCE **Volume:** 6 **Issue:** 10 **Pages:** 2235-2241 **DOI:** 10.1166/jctn.2009.1279 **Published:** OCT 2009

Accession Number: WOS:000272388300017

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Foroozani, Neda	H-2720-2013	

ISSN: 1546-1955

Record 33 of 55

Title: Two-impurity Kondo model with spin-orbit interactions

Author(s): Mross, DF (Mross, David F.); Johannesson, H (Johannesson, Henrik)

Source: PHYSICAL REVIEW B **Volume:** 80 **Issue:** 15 **Article Number:** 155302 **DOI:** 10.1103/PhysRevB.80.155302 **Published:** OCT 2009

Accession Number: WOS:000271352000077

ISSN: 1098-0121

Record 34 of 55

Title: Dynamical Wobbulations of Electronic Spin States in a Rashba Isotropic 2D Quantum Dot

Author(s): Safaiee, R (Safaiee, R.); Golshan, MM (Golshan, M. M.)

Source: JOURNAL OF COMPUTATIONAL AND THEORETICAL NANOSCIENCE **Volume:** 6 **Issue:** 5 **Pages:** 1045-1053 **DOI:** 10.1166/jctn.2009.1142 **Published:** MAY 2009

Accession Number: WOS:000265745000013

ISSN: 1546-1955

Record 35 of 55

Title: The Electronic Spin-Subbands States Entanglement in a Rashba 2D Isotropic Quantum Dot

Author(s): Safaiee, R (Safaiee, R.); Foroozani, N (Foroozani, N.); Golshan, MM (Golshan, M. M.)

Source: JOURNAL OF COMPUTATIONAL AND THEORETICAL NANOSCIENCE **Volume:** 6 **Issue:** 3 **Pages:** 686-691 **DOI:** 10.1166/jctn.2009.1095 **Published:** MAR 2009

Accession Number: WOS:000265349300036

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Foroozani, Neda	H-2720-2013	

ISSN: 1546-1955

Record 36 of 55

Title: Effects of quantum dot characteristics on electronic spin-subband state entanglement

Author(s): Safaiee, R (Safaiee, R.); Foroozani, N (Foroozani, N.); Golshan, MM (Golshan, M. M.)

Source: JOURNAL OF STATISTICAL MECHANICS-THEORY AND EXPERIMENT **Article Number:** P02038 **DOI:** 10.1088/1742-5468/2009/02/P02038 **Published:** FEB 2009

Accession Number: WOS:000263824300039

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Foroozani, Neda	H-2720-2013	

ISSN: 1742-5468

Record 37 of 55

Title: Spin Rotations Induced by an Electron Running in Closed Trajectories in Gated Semiconductor Nanodevices

Author(s): Bednarek, S (Bednarek, S.); Szafran, B (Szafran, B.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 101 **Issue:** 21 **Article Number:** 216805 **DOI:** 10.1103/PhysRevLett.101.216805 **Published:** NOV 21 2008

Accession Number: WOS:000261141500047

PubMed ID: 19113439

Author Identifiers:

Author	ResearcherID Number	ORCID Number
szafran, bartlomiej	A-1936-2017	
Szafran, Bartlomiej		0000-0001-6938-3247

ISSN: 0031-9007

Record 38 of 55

Title: Quantum computing with molecular magnets

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Trif, M (Trif, Mircea); Loss, D (Loss, Daniel)

Source: INORGANICA CHIMICA ACTA **Volume:** 361 **Issue:** 14-15 **Pages:** 3740-3745 **DOI:** 10.1016/j.ica.2008.02.066 **Published:** OCT 1 2008

Accession Number: WOS:000258664800002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Trif, Mircea	A-6703-2010	

ISSN: 0020-1693

eISSN: 1873-3255

Record 39 of 55

Title: Theory of spin qubits in nanostructures

Author(s): Trauzettel, B (Trauzettel, Bjoern); Borhani, M (Borhani, Massoud); Trif, M (Trif, Mircea); Loss, D (Loss, Daniel)

Source: JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN **Volume:** 77 **Issue:** 3 **Article Number:** 031012 **DOI:** 10.1143/JPSJ.77.031012 **Published:** MAR 2008

Accession Number: WOS:000254311900016

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trif, Mircea	A-6703-2010	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Trauzettel, Bjoern	C-4011-2017	0000-0002-7342-8425

ISSN: 0031-9015

Record 40 of 55

Title: Nuclear-induced time evolution of entanglement of two-electron spins in anisotropically coupled quantum dot

Author(s): Sadiek, G (Sadiek, Gehad); Huang, Z (Huang, Zhen); Aldossary, O (Aldossary, Omar); Kais, S (Kais, Sabre)

Source: MOLECULAR PHYSICS **Volume:** 106 **Issue:** 14 **Pages:** 1777-1786 **DOI:** 10.1080/00268970802290313 **Published:** 2008

Accession Number: WOS:000259649300007

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kais, Sabre		0000-0003-0574-5346

ISSN: 0026-8976

Record 41 of 55

Title: Effect of the Dzyaloshinski-Moriya term in the quantum (SWAP)(alpha) gate produced with exchange coupling

Author(s): Guerrero, RJ (Guerrero, Roberto J.); Rojas, F (Rojas, F.)

Source: PHYSICAL REVIEW A **Volume:** 77 **Issue:** 1 **Article Number:** 012331 **DOI:** 10.1103/PhysRevA.77.012331 **Published:** JAN 2008

Accession Number: WOS:000252862000063

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rojas, Fernando	C-7775-2009	0000-0002-3893-1850

ISSN: 1050-2947

Record 42 of 55

Title: Ideal switching effect in periodic spin-orbit coupling structures

Author(s): Gong, SJ (Gong, S. J.); Yang, ZQ (Yang, Z. Q.)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 19 **Issue:** 44 **Article Number:** 446209 **DOI:** 10.1088/0953-8984/19/44/446209 **Published:** NOV 7 2007

Accession Number: WOS:000250688400032

ISSN: 0953-8984

Record 43 of 55

Title: Quantum computation in semiconductor quantum dots of electron-spin asymmetric anisotropic exchange

Author(s): Hao, X (Hao, Xiang); Zhu, S (Zhu, Shiqun)

Source: PHYSICAL REVIEW A **Volume:** 76 **Issue:** 4 **Article Number:** 044306 **DOI:** 10.1103/PhysRevA.76.044306 **Published:** OCT 2007

Accession Number: WOS:000250619700224

ISSN: 1050-2947

Record 44 of 55

Title: Flying spin-qubit gates implemented through Dresselhaus and Rashba spin-orbit couplings

Author(s): Gong, SJ (Gong, S. J.); Yang, ZQ (Yang, Z. Q.)

Source: PHYSICS LETTERS A **Volume:** 367 **Issue:** 4-5 **Pages:** 369-372 **DOI:** 10.1016/j.physleta.2007.03.022 **Published:** JUL 30 2007

Accession Number: WOS:000249000600022

ISSN: 0375-9601

Record 45 of 55

Title: Exchange-controlled single-electron-spin rotations in quantum dots

Author(s): Coish, WA (Coish, W. A.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 16 **Article Number:** 161302 **DOI:** 10.1103/PhysRevB.75.161302 **Published:** APR 2007

Accession Number: WOS:000246075900006

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Coish, William	A-5521-2008	

ISSN: 1098-0121

Record 46 of 55

Title: Universal quantum computing with correlated spin-charge states

Author(s): Kyriakidis, J (Kyriakidis, Jordan); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 11 **Article Number:** 115324 **DOI:** 10.1103/PhysRevB.75.115324 **Published:** MAR 2007

Accession Number: WOS:000245329600091

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 1098-0121

Record 47 of 55

Title: Spin-spin coupling in electrostatically coupled quantum dots

Author(s): Trif, M (Trif, Mircea); Golovach, VN (Golovach, Vitaly N.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 8 **Article Number:** 085307 **DOI:** 10.1103/PhysRevB.75.085307 **Published:** FEB 2007

Accession Number: WOS:000244533800037

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trif, Mircea	A-6703-2010	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Golovach, Vitaly	B-6178-2014	0000-0001-7457-171X

ISSN: 2469-9950

eISSN: 2469-9969

Record 48 of 55

Title: Tunable few-electron quantum dots in InAs nanowires

Author(s): Shorubalko, I (Shorubalko, I.); Pfund, A (Pfund, A.); Leturcq, R (Leturcq, R.); Borgstrom, MT (Borgstroem, M. T.); Gramm, F (Gramm, F.); Muller, E (Mueller, E.); Gini, E (Gini, E.); Ensslin, K (Ensslin, K.)

Source: NANOTECHNOLOGY **Volume:** 18 **Issue:** 4 **Article Number:** 044014 **DOI:** 10.1088/0957-4484/18/4/044014 **Published:** JAN 31 2007

Accession Number: WOS:000243841000015

Conference Title: International Conference on Nanoscience and Technology

Conference Date: JUL 30-AUG 04, 2006

Conference Location: Basel, SWITZERLAND

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Borgstrom, Magnus	B-2237-2008	0000-0001-8061-0746
Shorubalko, Ivan	E-1089-2011	0000-0001-9868-7303

ISSN: 0957-4484

Record 49 of 55

Title: Spin-orbit mediated control of spin qubits

Author(s): Flindt, C (Flindt, Christian); Sorensen, AS (Sorensen, Anders S.); Flensberg, K (Flensberg, Karsten)

Source: PHYSICAL REVIEW LETTERS **Volume:** 97 **Issue:** 24 **Article Number:** 240501 **DOI:** 10.1103/PhysRevLett.97.240501 **Published:** DEC 15 2006

Accession Number: WOS:000242888700006

PubMed ID: 17280261

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Flensberg, Karsten	N-4718-2014	0000-0002-8311-0103
Sorensen, Anders	L-1868-2013	0000-0003-1337-9163
Flindt, Christian	H-4883-2011	0000-0002-7223-8400

ISSN: 0031-9007

Record 50 of 55

Title: RKKY interaction between quantum dot spins tuned by the quantum dot level

Author(s): Yang, M (Yang, Mou); Li, SS (Li, Shu-Shen)

Source: PHYSICAL REVIEW B **Volume:** 74 **Issue:** 7 **Article Number:** 073402 **DOI:** 10.1103/PhysRevB.74.073402 **Published:** AUG 2006

Accession Number: WOS:000240238800018

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yang, Mou	E-9382-2014	

ISSN: 1098-0121

Record 51 of 55

Title: Electric-field inversion asymmetry: Rashba and Stark effects for holes in resonant tunneling devices

Author(s): de Carvalho, HB (de Carvalho, H. B.); Brasil, MJSP (Brasil, M. J. S. P.); Lopez-Richard, V (Lopez-Richard, V.); Gobato, YG (Gobato, Y. Galvao); Marques, GE (Marques, G. E.); Camps, I (Camps, I.); Dacal, LCO (Dacal, L. C. O.); Henini, M (Henini, M.); Eaves, L (Eaves, L.); Hill, G (Hill, G.)

Source: PHYSICAL REVIEW B **Volume:** 74 **Issue:** 4 **Article Number:** 041305 **DOI:** 10.1103/PhysRevB.74.041305 **Published:** JUL 2006

Accession Number: WOS:000239426800006

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dacal, Luis	Q-7034-2016	0000-0003-4341-7191
Brasil, Maria Jose	I-7206-2013	
Inst. of Physics, Gleb Wataghin	A-9780-2017	
Lopez-Richard, Victor	L-9823-2013	0000-0002-7897-3860
Galvao Gobato, Yara	E-9712-2012	0000-0003-2251-0426
de Carvalho, H. B.	K-5651-2012	0000-0001-7183-7260
Marques, Gilmar Eugenio	G-3528-2015	0000-0002-8608-6508
Camps, I.	B-8929-2008	0000-0001-5898-1313
Henini, Mohamed	E-8520-2012	0000-0001-9414-8492
Eaves, Laurence		0000-0002-5334-0987

ISSN: 2469-9950

eISSN: 2469-9969

Record 52 of 55

Title: Detection and measurement of the Dzyaloshinskii-Moriya interaction in double quantum dot systems

Author(s): Chutia, S (Chutia, Sucismita); Friesen, M (Friesen, Mark); Joynt, R (Joynt, Robert)

Source: PHYSICAL REVIEW B **Volume:** 73 **Issue:** 24 **Article Number:** 241304 **DOI:** 10.1103/PhysRevB.73.241304 **Published:** JUN 2006

Accession Number: WOS:000238696900005

ISSN: 1098-0121

Record 53 of 55

Title: Design and control of spin gates in two quantum-dot arrays

Author(s): Usaj, G (Usaj, G); Balseiro, CA (Balseiro, CA)

Source: APPLIED PHYSICS LETTERS **Volume:** 88 **Issue:** 10 **Article Number:** 103103 **DOI:** 10.1063/1.2181275 **Published:** MAR 6 2006

Accession Number: WOS:000235905800061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Usaj, Gonzalo	E-6394-2010	0000-0002-3044-5778

ISSN: 0003-6951

eISSN: 1077-3118

Record 54 of 55

Title: Holonomic quantum computation in decoherence-free subspaces

Author(s): Wu, LA (Wu, LA); Zanardi, P (Zanardi, P); Lidar, DA (Lidar, DA)

Source: PHYSICAL REVIEW LETTERS **Volume:** 95 **Issue:** 13 **Article Number:** 130501 **DOI:** 10.1103/PhysRevLett.95.130501 **Published:** SEP 23 2005

Accession Number: WOS:000232060100004

PubMed ID: 16197125

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 0031-9007

Record 55 of 55

Title: Universal leakage elimination

Author(s): Byrd, MS (Byrd, MS); Lidar, DA (Lidar, DA); Wu, LA (Wu, LA); Zanardi, P (Zanardi, P)

Source: PHYSICAL REVIEW A **Volume:** 71 **Issue:** 5 **Article Number:** 052301 **DOI:** 10.1103/PhysRevA.71.052301 **Published:** MAY 2005

Accession Number: WOS:000229543600015

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 2469-9926
eISSN: 2469-9934

Record 1 of 51

Title: Leakage and sweet spots in triple-quantum-dot spin qubits: A molecular-orbital study

Author(s): Zhang, CX (Zhang, Chengxian); Yang, XC (Yang, Xu-Chen); Wang, X (Wang, Xin)

Source: PHYSICAL REVIEW A **Volume:** 97 **Issue:** 4 **Article Number:** 042326 **DOI:** 10.1103/PhysRevA.97.042326 **Published:** APR 16 2018

Accession Number: WOS:000430054000003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yang, Xu-Chen	O-3405-2017	0000-0001-5058-8496

ISSN: 2469-9926

eISSN: 2469-9934

Record 2 of 51

Title: Symmetric spin-orbit interaction in triple quantum dot and minimisation of spin-orbit leakage in CNOT gate

Author(s): Milivojevic, M (Milivojevic, Marko)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 30 **Issue:** 8 **Article Number:** 085302 **DOI:** 10.1088/1361-648X/aaa736 **Published:** FEB 28 2018

Accession Number: WOS:000424236800001

PubMed ID: 29328053

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Milivojevic, Marko		0000-0002-9583-3640

ISSN: 0953-8984

eISSN: 1361-648X

Record 3 of 51

Title: Anisotropy and Suppression of Spin-Orbit Interaction in a GaAs Double Quantum Dot

Author(s): Hofmann, A (Hofmann, A.); Maisi, VF (Maisi, V. F.); Krahenmann, T (Krahenmann, T.); Reichl, C (Reichl, C.); Wegscheider, W (Wegscheider, W.); Ensslin, K (Ensslin, K.); Ihn, T (Ihn, T.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 119 **Issue:** 17 **Article Number:** 176807 **DOI:** 10.1103/PhysRevLett.119.176807 **Published:** OCT 27 2017

Accession Number: WOS:000413851200009

PubMed ID: 29219432

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ihn, Thomas	A-4470-2018	0000-0002-5587-6953
Maisi, Ville	C-2950-2014	

ISSN: 0031-9007

eISSN: 1079-7114

Record 4 of 51

Title: Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin-orbit interaction

Author(s): Milivojevic, M (Milivojevic, Marko); Stepanenko, D (Stepanenko, Dimitrije)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 29 **Issue:** 40 **Article Number:** 405302 **DOI:** 10.1088/1361-648X/aa7f86 **Published:** OCT 11 2017

Accession Number: WOS:000425258500001

PubMed ID: 28703716

ISSN: 0953-8984

eISSN: 1361-648X

Record 5 of 51

Title: Spin-orbit coupling in quasi-one-dimensional Wigner crystals

Author(s): Kornich, V (Kornich, Viktoriia); Pedder, CJ (Pedder, Christopher J.); Schmidt, TL (Schmidt, Thomas L.)

Source: PHYSICAL REVIEW B **Volume:** 95 **Issue:** 4 **Article Number:** 045413 **DOI:** 10.1103/PhysRevB.95.045413 **Published:** JAN 17 2017

Accession Number: WOS:000392074700014

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schmidt, Thomas	C-7394-2011	0000-0003-0382-1237
Schmidt, Thomas		0000-0002-1473-3913

ISSN: 2469-9950

eISSN: 2469-9969

Record 6 of 51

Title: Spin-Orbit Coupling at the Level of a Single Electron

Author(s): Maisi, VF (Maisi, V. F.); Hofmann, A (Hofmann, A.); Roosli, M (Roeoesli, M.); Basset, J (Basset, J.); Reichl, C (Reichl, C.); Wegscheider, W (Wegscheider, W.); Ihn, T (Ihn, T.); Ensslin, K (Ensslin, K.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 116 **Issue:** 13 **Article Number:** 136803 **DOI:** 10.1103/PhysRevLett.116.136803 **Published:** MAR 30 2016

Accession Number: WOS:000373099500014

PubMed ID: 27081997

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Maisi, Ville	C-2950-2014	
Ihn, Thomas	A-4470-2018	0000-0002-5587-6953

ISSN: 0031-9007

eISSN: 1079-7114

Record 7 of 51

Title: Two-qubit couplings of singlet-triplet qubits mediated by one quantum state

Author(s): Mehl, S (Mehl, Sebastian); Bluhm, H (Bluhm, Hendrik); DiVincenzo, DP (DiVincenzo, David P.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 4 **Article Number:** 045404 **DOI:** 10.1103/PhysRevB.90.045404 **Published:** JUL 9 2014

Accession Number: WOS:000338738600014

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254
DiVincenzo, David	H-5952-2013	0000-0003-4332-645X

ISSN: 2469-9950

eISSN: 2469-9969

Record 8 of 51

Title: Coherent-state spin qubits in the presence of spin-orbit coupling

Author(s): Owen, ET (Owen, E. T.); Dean, MC (Dean, M. C.); Barnes, CHW (Barnes, C. H. W.)

Source: PHYSICAL REVIEW A **Volume:** 89 **Issue:** 3 **Article Number:** 032305 **DOI:** 10.1103/PhysRevA.89.032305 **Published:** MAR 6 2014

Accession Number: WOS:000332340800001

ISSN: 1050-2947

eISSN: 1094-1622

Record 9 of 51

Title: Phonon-mediated decay of singlet-triplet qubits in double quantum dots

Author(s): Kornich, V (Kornich, Viktoriia); Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 8 **Article Number:** 085410 **DOI:** 10.1103/PhysRevB.89.085410 **Published:** FEB 12 2014

Accession Number: WOS:000332384300003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 2469-9950

eISSN: 2469-9969

Record 10 of 51

Title: Precision control of charge coherence in parallel double dot systems through spin-orbit interaction

Author(s): Jin, JS (Jin, Jinshuang); Tu, MWY (Tu, Matisse Wei-Yuan); Wang, NE (Wang, Nien-En); Zhang, WM (Zhang, Wei-Min)

Source: JOURNAL OF CHEMICAL PHYSICS **Volume:** 139 **Issue:** 6 **Article Number:** 064706 **DOI:** 10.1063/1.4817850 **Published:** AUG 14 2013

Accession Number: WOS:000323177900043

PubMed ID: 23947879

Author Identifiers:

Author	ResearcherID Number	ORCID Number
ZHANG, Wei-Min	Q-3713-2016	0000-0003-2117-3608

ISSN: 0021-9606

Record 11 of 51

Title: Spin-orbit coupled particle in a spin bath

Author(s): Stano, P (Stano, Peter); Fabian, J (Fabian, Jaroslav); Zutic, I (Zutic, Igor)

Source: PHYSICAL REVIEW B **Volume:** 87 **Issue:** 16 **Article Number:** 165303 **DOI:** 10.1103/PhysRevB.87.165303 **Published:** APR 12 2013

Accession Number: WOS:000317585900005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525
Stano, Peter	C-3016-2013	0000-0001-5835-0765

ISSN: 2469-9950

eISSN: 2469-9969

Record 12 of 51

Title: Alternative experimental protocol to demonstrate the Pusey-Barrett-Rudolph theorem

Author(s): Miller, DJ (Miller, D. J.)

Source: PHYSICAL REVIEW A **Volume:** 87 **Issue:** 1 **Article Number:** 014103 **DOI:** 10.1103/PhysRevA.87.014103 **Published:** JAN 16 2013

Accession Number: WOS:000313546100019

ISSN: 1050-2947

Record 13 of 51

Title: Prospects for Spin-Based Quantum Computing in Quantum Dots

Author(s): Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Edited by: Langer JS

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 4 **Book Series:** Annual Review of Condensed Matter Physics **Volume:** 4 **Pages:** 51-81 **DOI:** 10.1146/annurev-conmatphys-030212-184248 **Published:** 2013

Accession Number: WOS:000321694300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1947-5454

ISBN: 978-0-8243-5004-8

Record 14 of 51

Title: Exchange-based CNOT gates for singlet-triplet qubits with spin-orbit interaction

Author(s): Klinovaja, J (Klinovaja, Jelena); Stepanenko, D (Stepanenko, Dimitrije); Halperin, BI (Halperin, Bertrand I.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 8 **Article Number:** 085423 **DOI:** 10.1103/PhysRevB.86.085423 **Published:** AUG 13 2012

Accession Number: WOS:000307441900012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Klinovaja, Jelena	L-2510-2013	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 15 of 51

Title: Electron Mediated Mn-Mn Interaction in Quantum Dots

Author(s): Bak, Z (Bak, Z.)

Source: ACTA PHYSICA POLONICA A **Volume:** 121 **Issue:** 5-6 **Pages:** 1219-1221 **DOI:** 10.12693/APhysPolA.121.1219 **Published:** MAY-JUN 2012

Accession Number: WOS:000304789500071

Conference Title: European Conference on Physics of Magnetism (PM)

Conference Date: JUN 27-JUL 01, 2011

Conference Location: Poznan, POLAND

Conference Sponsors: Polish Acad Sci, Inst Mol Phys, Adam Mickewicz Univ, Fac Phys

ISSN: 0587-4246

Record 16 of 51

Title: Spin manipulation and relaxation in spin-orbit qubits

Author(s): Borhani, M (Borhani, Massoud); Hu, XD (Hu, Xuedong)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 12 **Article Number:** 125132 **DOI:** 10.1103/PhysRevB.85.125132 **Published:** MAR 28 2012

Accession Number: WOS:000302004100002

ISSN: 1098-0121

Record 17 of 51

Title: Singlet-triplet splitting in double quantum dots due to spin-orbit and hyperfine interactions

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Rudner, M (Rudner, Mark); Halperin, BI (Halperin, Bertrand I.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 7 **Article Number:** 075416 **DOI:** 10.1103/PhysRevB.85.075416 **Published:** FEB 16 2012

Accession Number: WOS:000300419500002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rudner, Mark	C-9325-2015	0000-0002-5150-6234
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 18 of 51

Title: Generation of entanglement between qubits in a one-dimensional harmonic oscillator

Author(s): Owen, ET (Owen, E. T.); Dean, MC (Dean, M. C.); Barnes, CHW (Barnes, C. H. W.)

Source: PHYSICAL REVIEW A **Volume:** 85 **Issue:** 2 **Article Number:** 022319 **DOI:** 10.1103/PhysRevA.85.022319 **Published:** FEB 14 2012

Accession Number: WOS:000300237000001

ISSN: 1050-2947

Record 19 of 51

Title: Electric Field Control of Magnetic Coupling in a Double Quantum Dot System and Related Parasitic Electric Dipole Effect

Author(s): Bak, Z (Bak, Z.)

Source: ACTA PHYSICA POLONICA A **Volume:** 118 **Issue:** 5 **Pages:** 957-958 **DOI:** 10.12693/APhysPolA.118.957 **Published:** NOV 2010

Accession Number: WOS:000285797100100

Conference Title: 14th Czech and Slovak Conference on Magnetism

Conference Date: JUN 06-09, 2010

Conference Location: Kosice, SLOVAKIA

Conference Sponsors: Safarik Univ, Fac Sci, Inst Phys, Slovak Acad Sci, Slovak Phys Soc

ISSN: 0587-4246

Record 20 of 51

Title: Optimal control landscape for the generation of unitary transformations with constrained dynamics

Author(s): Hsieh, M (Hsieh, Michael); Wu, RB (Wu, Rebing); Rabitz, H (Rabitz, Herschel); Lidar, D (Lidar, Daniel)

Source: PHYSICAL REVIEW A **Volume:** 81 **Issue:** 6 **Article Number:** 062352 **DOI:** 10.1103/PhysRevA.81.062352 **Published:** JUN 30 2010

Accession Number: WOS:000279380300005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lidar, Daniel	A-5871-2008	0000-0002-1671-1515
Wu, Rebing	A-3647-2013	0000-0003-3545-8700

ISSN: 2469-9926

eISSN: 2469-9934

Record 21 of 51

Title: Proposal of a full Bell state analyzer for spin qubits in a double quantum dot

Author(s): Yokoshi, N (Yokoshi, Nobuhiko); Imamura, H (Imamura, Hiroshi); Kosaka, H (Kosaka, Hideo)

Source: PHYSICAL REVIEW B **Volume:** 81 **Issue:** 16 **Article Number:** 161305 **DOI:** 10.1103/PhysRevB.81.161305 **Published:** APR 15 2010

Accession Number: WOS:000277217200012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Imamura, Hiroshi	O-5748-2016	
Yokoshi, Nobuhiko		0000-0003-2949-5943

ISSN: 1098-0121

Record 22 of 51

Title: Theory of Anisotropic Exchange in Laterally Coupled Quantum Dots

Author(s): Baruffa, F (Baruffa, Fabio); Stano, P (Stano, Peter); Fabian, J (Fabian, Jaroslav)

Source: PHYSICAL REVIEW LETTERS **Volume:** 104 **Issue:** 12 **Article Number:** 126401 **DOI:** 10.1103/PhysRevLett.104.126401 **Published:** MAR 26 2010

Accession Number: WOS:000276072400036

PubMed ID: 20366552

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Stano, Peter	C-3016-2013	0000-0001-5835-0765
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525

ISSN: 0031-9007

Record 23 of 51

Title: Concatenated cranking representation of the Schrodinger equation and resolution to pulsed quantum operations with spin exchange

Author(s): Ding, ZG (Ding, Zhi-Gang); Cen, LX (Cen, Li-Xiang); Wang, SJ (Wang, ShunJin)

Source: PHYSICAL REVIEW A **Volume:** 81 **Issue:** 3 **Article Number:** 032337 **DOI:** 10.1103/PhysRevA.81.032337 **Published:** MAR 2010

Accession Number: WOS:000276262500086

ISSN: 1050-2947

eISSN: 1094-1622

Record 24 of 51

Title: Exchange coupling in silicon quantum dots: Theoretical considerations for quantum computation

Author(s): Li, QZ (Li, Qiuzi); Cywinski, L (Cywinski, Lukasz); Culcer, D (Culcer, Dimitrie); Hu, XD (Hu, Xuedong); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW B **Volume:** 81 **Issue:** 8 **Article Number:** 085313 **DOI:** 10.1103/PhysRevB.81.085313 **Published:** FEB 2010

Accession Number: WOS:000275053300080

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X
Li, Qiuzi	F-6474-2011	
Cywinski, Lukasz	E-5348-2010	0000-0002-0162-7943

ISSN: 1098-0121

Record 25 of 51

Title: Electronic properties of quantum dot systems realized in semiconductor nanowires

Author(s): Salfi, J (Salfi, J.); Roddaro, S (Roddaro, S.); Ercolani, D (Ercolani, D.); Sorba, L (Sorba, L.); Savelyev, I (Savelyev, I.); Blumin, M (Blumin, M.); Ruda, HE (Ruda, H. E.); Beltram, F (Beltram, F.)

Source: SEMICONDUCTOR SCIENCE AND TECHNOLOGY **Volume:** 25 **Issue:** 2 **Special Issue:** SI **Article Number:** 024007 **DOI:** 10.1088/0268-1242/25/2/024007 **Published:** FEB 2010

Accession Number: WOS:000273852300008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ercolani, Daniele	B-1638-2012	0000-0003-2556-0736
Ruda, Harry	G-5696-2017	
Roddaro, Stefano	C-6303-2008	0000-0002-4707-1434
Beltram, Fabio	F-2920-2013	0000-0002-6081-436X
Sorba, Lucia	B-8949-2015	0000-0001-6242-9417
Salfi, Joseph		0000-0001-9240-4245

ISSN: 0268-1242

Record 26 of 51

Title: Adiabatic pumping in a double quantum dot structure with strong spin-orbit interaction

Author(s): Romeo, F (Romeo, F.); Citro, R (Citro, R.)

Source: PHYSICAL REVIEW B **Volume:** 80 **Issue:** 16 **Article Number:** 165311 **DOI:** 10.1103/PhysRevB.80.165311 **Published:** OCT 2009

Accession Number: WOS:000271352100086

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Romeo, Francesco	H-1209-2012	0000-0001-6322-7374
Citro, Roberta	I-1596-2012	

ISSN: 2469-9950

eISSN: 2469-9969

Record 27 of 51

Title: Electrical Measurement of a Two-Electron Spin State in a Double Quantum Dot

Author(s): Yokoshi, N (Yokoshi, Nobuhiko); Imamura, H (Imamura, Hiroshi); Kosaka, H (Kosaka, Hideo)

Source: PHYSICAL REVIEW LETTERS **Volume:** 103 **Issue:** 4 **Article Number:** 046806 **DOI:** 10.1103/PhysRevLett.103.046806 **Published:** JUL 24 2009

Accession Number: WOS:000268307400054

PubMed ID: 19659384

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Imamura, Hiroshi	O-5748-2016	
Yokoshi, Nobuhiko		0000-0003-2949-5943

ISSN: 0031-9007

Record 28 of 51

Title: Aharonov-Casher Effect in Exchange Interactions in a Wigner Crystal

Author(s): Tserkovnyak, Y (Tserkovnyak, Yaroslav); Kindermann, M (Kindermann, Markus)

Source: PHYSICAL REVIEW LETTERS **Volume:** 102 **Issue:** 12 **Article Number:** 126801 **DOI:** 10.1103/PhysRevLett.102.126801 **Published:** MAR 27 2009

Accession Number: WOS:000264632100049

PubMed ID: 19392304

ISSN: 0031-9007

Record 29 of 51

Title: Dynamics of coupled spins in quantum dots with strong spin-orbit interaction

Author(s): Pfund, A (Pfund, A.); Shorubalko, I (Shorubalko, I.); Ensslin, K (Ensslin, K.); Leturcq, R (Leturcq, R.)

Source: PHYSICAL REVIEW B **Volume:** 79 **Issue:** 12 **Article Number:** 121306 **DOI:** 10.1103/PhysRevB.79.121306 **Published:** MAR 2009

Accession Number: WOS:000264769300010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Shorubalko, Ivan	E-1089-2011	0000-0001-9868-7303

ISSN: 1098-0121

eISSN: 1550-235X

Record 30 of 51

Title: Crossover from the ballistic to the resonant tunneling transport for an ideal one-dimensional quantum ring with spin-orbit interaction

Author(s): Bellucci, S (Bellucci, S.); Onorato, P (Onorato, P.)

Source: PHYSICAL REVIEW B **Volume:** 78 **Issue:** 23 **Article Number:** 235312 **DOI:** 10.1103/PhysRevB.78.235312 **Published:** DEC 2008

Accession Number: WOS:000262245400075

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bellucci, Stefano	C-9235-2011	
Bellucci, Stefano		0000-0003-0326-6368
Onorato, Pasquale		0000-0002-2110-7582

ISSN: 2469-9950

eISSN: 2469-9969

Record 31 of 51

Title: Spin-orbit coupling and the singlet-triplet transition in lateral double quantum dots

Author(s): Meza-Montes, L (Meza-Montes, L.); Destefani, CF (Destefani, Carlos F.); Ulloa, SE (Ulloa, Sergio E.)

Source: PHYSICAL REVIEW B **Volume:** 78 **Issue:** 20 **Article Number:** 205307 **DOI:** 10.1103/PhysRevB.78.205307 **Published:** NOV 2008

Accession Number: WOS:000261215400046

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ulloa, Sergio	F-4621-2011	0000-0002-3091-4984

ISSN: 1098-0121

Record 32 of 51

Title: Quantum computing with molecular magnets

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Trif, M (Trif, Mircea); Loss, D (Loss, Daniel)

Source: INORGANICA CHIMICA ACTA **Volume:** 361 **Issue:** 14-15 **Pages:** 3740-3745 **DOI:** 10.1016/j.ica.2008.02.066 **Published:** OCT 1 2008

Accession Number: WOS:000258664800002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Trif, Mircea	A-6703-2010	

ISSN: 0020-1693

eISSN: 1873-3255

Record 33 of 51

Title: Spin-orbit-mediated anisotropic spin interaction in interacting electron systems

Author(s): Gangadharaiah, S (Gangadharaiah, Suhas); Sun, JM (Sun, Jianmin); Starykh, OA (Starykh, Oleg A.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 100 **Issue:** 15 **Article Number:** 156402 **DOI:** 10.1103/PhysRevLett.100.156402 **Published:** APR 18 2008

Accession Number: WOS:000255117800049

PubMed ID: 18518133

ISSN: 0031-9007

Record 34 of 51

Title: Theory of spin qubits in nanostructures

Author(s): Trauzettel, B (Trauzettel, Bjoern); Borhani, M (Borhani, Massoud); Trif, M (Trif, Mircea); Loss, D (Loss, Daniel)

Source: JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN **Volume:** 77 **Issue:** 3 **Article Number:** 031012 **DOI:** 10.1143/JPSJ.77.031012 **Published:** MAR 2008

Accession Number: WOS:000254311900016

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trif, Mircea	A-6703-2010	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Trauzettel, Bjoern	C-4011-2017	0000-0002-7342-8425

ISSN: 0031-9015

Record 35 of 51

Title: Quantum computation in semiconductor quantum dots of electron-spin asymmetric anisotropic exchange

Author(s): Hao, X (Hao, Xiang); Zhu, S (Zhu, Shiqun)

Source: PHYSICAL REVIEW A **Volume:** 76 **Issue:** 4 **Article Number:** 044306 **DOI:** 10.1103/PhysRevA.76.044306 **Published:** OCT 2007

Accession Number: WOS:000250619700224

ISSN: 1050-2947

Record 36 of 51

Title: Spin-spin coupling in electrostatically coupled quantum dots

Author(s): Trif, M (Trif, Mircea); Golovach, VN (Golovach, Vitaly N.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 75 **Issue:** 8 **Article Number:** 085307 **DOI:** 10.1103/PhysRevB.75.085307 **Published:** FEB 2007

Accession Number: WOS:000244533800037

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Trif, Mircea	A-6703-2010	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Golovach, Vitaly	B-6178-2014	0000-0001-7457-171X

ISSN: 2469-9950

eISSN: 2469-9969

Record 37 of 51

Title: Tunable few-electron quantum dots in InAs nanowires

Author(s): Shorubalko, I (Shorubalko, I.); Pfund, A (Pfund, A.); Leturcq, R (Leturcq, R.); Borgstrom, MT (Borgstroem, M. T.); Gramm, F (Gramm, F.); Muller, E (Mueller, E.); Gini, E (Gini, E.); Ensslin, K (Ensslin, K.)

Source: NANOTECHNOLOGY **Volume:** 18 **Issue:** 4 **Article Number:** 044014 **DOI:** 10.1088/0957-4484/18/4/044014 **Published:** JAN 31 2007

Accession Number: WOS:000243841000015

Conference Title: International Conference on Nanoscience and Technology

Conference Date: JUL 30-AUG 04, 2006

Conference Location: Basel, SWITZERLAND

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Borgstrom, Magnus	B-2237-2008	0000-0001-8061-0746
Shorubalko, Ivan	E-1089-2011	0000-0001-9868-7303

ISSN: 0957-4484

Record 38 of 51

Title: Spin-orbit mediated control of spin qubits

Author(s): Flindt, C (Flindt, Christian); Sorensen, AS (Sorensen, Anders S.); Flensberg, K (Flensberg, Karsten)

Source: PHYSICAL REVIEW LETTERS **Volume:** 97 **Issue:** 24 **Article Number:** 240501 **DOI:** 10.1103/PhysRevLett.97.240501 **Published:** DEC 15 2006

Accession Number: WOS:000242888700006

PubMed ID: 17280261

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Flensberg, Karsten	N-4718-2014	0000-0002-8311-0103
Sorensen, Anders	L-1868-2013	0000-0003-1337-9163
Flindt, Christian	H-4883-2011	0000-0002-7223-8400

ISSN: 0031-9007

Record 39 of 51

Title: Scheme for direct measurement of a general two-qubit Hamiltonian

Author(s): Devitt, SJ (Devitt, SJ); Cole, JH (Cole, JH); Hollenberg, LCL (Hollenberg, LCL)

Source: PHYSICAL REVIEW A **Volume:** 73 **Issue:** 5 **Article Number:** 052317 **DOI:** 10.1103/PhysRevA.73.052317 **Published:** MAY 2006

Accession Number: WOS:000237949300047

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Cole, Jared	G-2992-2010	0000-0002-8943-6518
Hollenberg, Lloyd	B-2296-2010	
Devitt, Simon	C-3716-2008	0000-0002-5901-1391
HOLLENBERG, LLOYD		0000-0001-7672-6965

ISSN: 1050-2947

Record 40 of 51

Title: Design and control of spin gates in two quantum-dot arrays

Author(s): Usaj, G (Usaj, G); Balseiro, CA (Balseiro, CA)

Source: APPLIED PHYSICS LETTERS **Volume:** 88 **Issue:** 10 **Article Number:** 103103 **DOI:** 10.1063/1.2181275 **Published:** MAR 6 2006

Accession Number: WOS:000235905800061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Usaj, Gonzalo	E-6394-2010	0000-0002-3044-5778

ISSN: 0003-6951

eISSN: 1077-3118

Record 41 of 51

Title: Spin-based quantum dot quantum computing

Author(s): Hu, X (Hu, X)

Edited by: Fabian J; Fabian J; Hohenester U

Source: QUANTUM COHERENCE: FROM QUARKS TO SOLIDS **Book Series:** Lecture Notes in Physics **Volume:** 689 **Pages:** 83-114 **Published:** 2006

Accession Number: WOS:000236351800003

Conference Title: 42th Schladming Winter School on Quantum Coherence in Matter - From Quarks to Solids

Conference Date: FEB 28-MAR 06, 2004

Conference Location: Schladming, AUSTRIA

Conference Sponsors: Univ Graz, Div Theoret Phys

ISSN: 0075-8450

ISBN: 3-540-30085-6

Record 42 of 51

Title: Asymmetric exchange between electron spins in coupled semiconductor quantum dots

Author(s): Badescu, SC (Badescu, SC); Lyanda-Geller, YB (Lyanda-Geller, YB); Reinecke, TL (Reinecke, TL)

Source: PHYSICAL REVIEW B **Volume:** 72 **Issue:** 16 **Article Number:** 161304 **DOI:** 10.1103/PhysRevB.72.161304 **Published:** OCT 2005

Accession Number: WOS:000232934900008

ISSN: 2469-9950

eISSN: 2469-9969

Record 43 of 51

Title: Spin-orbit effects in single-electron states in coupled quantum dots

Author(s): Stano, P (Stano, P); Fabian, J (Fabian, J)

Source: PHYSICAL REVIEW B **Volume:** 72 **Issue:** 15 **Article Number:** 155410 **DOI:** 10.1103/PhysRevB.72.155410 **Published:** OCT 2005

Accession Number: WOS:000232934400116

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Fabian, Jaroslav	K-1700-2013	0000-0002-3009-4525
Stano, Peter	C-3016-2013	0000-0001-5835-0765

ISSN: 2469-9950

eISSN: 2469-9969

Record 44 of 51

Title: Holonomic quantum computation in decoherence-free subspaces

Author(s): Wu, LA (Wu, LA); Zanardi, P (Zanardi, P); Lidar, DA (Lidar, DA)

Source: PHYSICAL REVIEW LETTERS **Volume:** 95 **Issue:** 13 **Article Number:** 130501 **DOI:** 10.1103/PhysRevLett.95.130501 **Published:** SEP 23 2005

Accession Number: WOS:000232060100004

PubMed ID: 16197125

Author Identifiers:

Author	ResearcherID Number	ORCID Number

Lidar, Daniel	A-5871-2008	0000-0002-1671-1515

ISSN: 0031-9007

Record 45 of 51

Title: Spin-orbit coupling and anisotropy of spin splitting in quantum dots

Author(s): Konemann, J (Konemann, J); Haug, RJ (Haug, RJ); Maude, DK (Maude, DK); Fal'ko, VI (Fal'ko, VI); Altshuler, BL (Altshuler, BL)

Source: PHYSICAL REVIEW LETTERS **Volume:** 94 **Issue:** 22 **Article Number:** 226404 **DOI:** 10.1103/PhysRevLett.94.226404 **Published:** JUN 10 2005

Accession Number: WOS:000229700800051

PubMed ID: 16090418

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schaff, William	B-5839-2009	
Haug, Rolf	L-2769-2017	0000-0002-2220-3779
Fal'ko, Vladimir		0000-0003-0828-0310

ISSN: 0031-9007

Record 46 of 51

Title: Recipes for spin-based quantum computing

Author(s): Cerletti, V (Cerletti, V); Coish, WA (Coish, WA); Gywat, O (Gywat, O); Loss, D (Loss, D)

Source: NANOTECHNOLOGY **Volume:** 16 **Issue:** 4 **Pages:** R27-R49 **DOI:** 10.1088/0957-4484/16/4/R01 **Published:** APR 2005

Accession Number: WOS:000228949300009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coish, William	A-5521-2008	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0957-4484

eISSN: 1361-6528

Record 47 of 51

Title: Double occupancy errors in quantum computing operations: Corrections to adiabaticity

Author(s): Requist, R (Requist, R); Schliemann, J (Schliemann, J); Abanov, AG (Abanov, AG); Loss, D (Loss, D)

Source: PHYSICAL REVIEW B **Volume:** 71 **Issue:** 11 **Article Number:** 115315 **DOI:** 10.1103/PhysRevB.71.115315 **Published:** MAR 2005

Accession Number: WOS:000228065500090

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schliemann, John	D-4038-2013	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

eISSN: 1550-235X

Record 48 of 51

Title: Universal quantum computation through control of spin-orbit coupling

Author(s): Stepanenko, D (Stepanenko, D); Bonesteel, NE (Bonesteel, NE)

Source: PHYSICAL REVIEW LETTERS **Volume:** 93 **Issue:** 14 **Article Number:** 140501 **DOI:** 10.1103/PhysRevLett.93.140501 **Published:** OCT 1 2004

Accession Number: WOS:000224211900009

PubMed ID: 15524778

ISSN: 0031-9007

Record 49 of 51

Title: Symmetry of anisotropic exchange interactions in semiconductor nanostructures

Author(s): Kavokin, KV (Kavokin, KV)

Source: PHYSICAL REVIEW B **Volume:** 69 **Issue:** 7 **Article Number:** 075302 **DOI:** 10.1103/PhysRevB.69.075302 **Published:** FEB 2004

Accession Number: WOS:000220055300061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kavokin, Kirill	I-7736-2013	0000-0002-0047-5706

ISSN: 1098-0121

Record 50 of 51

Title: Relaxation of candidate electron spin qubits

Author(s): Lyon, SA (Lyon, SA)

Edited by: Smulko JM; Blanter Y; Dykman M; Kish LB

Source: NOISE AND INFORMATION IN NANOELECTRONICS, SENSORS, AND STANDARDS II **Book Series:** PROCEEDINGS OF THE SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS (SPIE) **Volume:** 5472 **Pages:** 97-106 **DOI:** 10.1117/12.550634 **Published:** 2004

Accession Number: WOS:000223225600013

Conference Title: Conference on Noise and Information in Nanoelectronics, Sensors and Standards II

Conference Date: MAY 26-28, 2004

Conference Location: Maspalomas, SPAIN

Conference Sponsors: SPIE

ISSN: 0277-786X

ISBN: 0-8194-5394-3

Record 51 of 51

Title: Anisotropic transport in a two-dimensional electron gas in the presence of spin-orbit coupling

Author(s): Schliemann, J (Schliemann, J); Loss, D (Loss, D)

Source: PHYSICAL REVIEW B **Volume:** 68 **Issue:** 16 **Article Number:** 165311 **DOI:** 10.1103/PhysRevB.68.165311 **Published:** OCT 15 2003

Accession Number: WOS:000186571800042

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schliemann, John	D-4038-2013	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 1 of 43

Title: Optimal control of universal quantum gates in a double quantum dot

Author(s): Castelano, LK (Castelano, Leonardo K.); de Lima, EF (de Lima, Emanuel F.); Madureira, JR (Madureira, Justino R.); Degani, MH (Degani, Marcos H.); Maialle, MZ (Maialle, Marcelo Z.)

Source: PHYSICAL REVIEW B **Volume:** 97 **Issue:** 23 **Article Number:** 235301 **DOI:** 10.1103/PhysRevB.97.235301 **Published:** JUN 4 2018

Accession Number: WOS:000434015400003

ISSN: 2469-9950

eISSN: 2469-9969

Record 2 of 43

Title: Leakage and sweet spots in triple-quantum-dot spin qubits: A molecular-orbital study

Author(s): Zhang, CX (Zhang, Chengxian); Yang, XC (Yang, Xu-Chen); Wang, X (Wang, Xin)

Source: PHYSICAL REVIEW A **Volume:** 97 **Issue:** 4 **Article Number:** 042326 **DOI:** 10.1103/PhysRevA.97.042326 **Published:** APR 16 2018

Accession Number: WOS:000430054000003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yang, Xu-Chen	O-3405-2017	0000-0001-5058-8496

ISSN: 2469-9926

eISSN: 2469-9934

Record 3 of 43

Title: Anisotropy and Suppression of Spin-Orbit Interaction in a GaAs Double Quantum Dot

Author(s): Hofmann, A (Hofmann, A.); Maisi, VF (Maisi, V. F.); Krahenmann, T (Krahenmann, T.); Reichl, C (Reichl, C.); Wegscheider, W (Wegscheider, W.); Ensslin, K (Ensslin, K.); Ihn, T (Ihn, T.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 119 **Issue:** 17 **Article Number:** 176807 **DOI:** 10.1103/PhysRevLett.119.176807 **Published:** OCT 27 2017

Accession Number: WOS:000413851200009

PubMed ID: 29219432

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ihn, Thomas	A-4470-2018	0000-0002-5587-6953
Maisi, Ville	C-2950-2014	

ISSN: 0031-9007

eISSN: 1079-7114

Record 4 of 43

Title: Intrinsic errors in transporting a single-spin qubit through a double quantum dot

Author(s): Li, X (Li, Xiao); Barnes, E (Barnes, Edwin); Kestner, JP (Kestner, J. P.); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW A **Volume:** 96 **Issue:** 1 **Article Number:** 012309 **DOI:** 10.1103/PhysRevA.96.012309 **Published:** JUL 6 2017

Accession Number: WOS:000405017900004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Li, Xiao	A-1612-2013	0000-0002-1708-4314
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X

ISSN: 2469-9926

eISSN: 2469-9934

Record 5 of 43

Title: Manipulation of Pauli spin blockade in double quantum dot systems

Author(s): Hou, WJ (Hou, WenJie); Wang, YD (Wang, YuanDong); Wei, JH (Wei, JianHua); Yan, YJ (Yan, YiJing)

Source: JOURNAL OF CHEMICAL PHYSICS **Volume:** 146 **Issue:** 22 **Article Number:** 224304 **DOI:** 10.1063/1.4985146 **Published:** JUN 14 2017

Accession Number: WOS:000403373900020

PubMed ID: 29166066

ISSN: 0021-9606

eISSN: 1089-7690

Record 6 of 43

Title: Bipolar spin blockade, many-body tunneling and long-range resonance in triple quantum dots

Author(s): Hou, WJ (Hou, WenJie); Wang, YD (Wang, YuanDong); Wei, JH (Wei, JianHua)

Source: EPL **Volume:** 118 **Issue:** 6 **Article Number:** 67002 **DOI:** 10.1209/0295-5075/118/67002 **Published:** JUN 2017

Accession Number: WOS:000408589400011
ISSN: 0295-5075
eISSN: 1286-4854

Record 7 of 43

Title: Spin-orbit signatures in the dynamics of singlet-triplet qubits in double quantum dots

Author(s): Rolon, JE (Rolon, Juan E.); Cota, E (Cota, Ernesto); Ulloa, SE (Ulloa, Sergio E.)

Source: PHYSICAL REVIEW B **Volume:** 95 **Issue:** 19 **Article Number:** 195407 **DOI:** 10.1103/PhysRevB.95.195407 **Published:** MAY 8 2017
Accession Number: WOS:000401229000007

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ulloa, Sergio		0000-0002-3091-4984

ISSN: 2469-9950
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Record 8 of 43

Title: Electron spin-flip correlations due to nuclear dynamics in driven GaAs double dots

Author(s): Pal, A (Pal, Arijeet); Nichol, JM (Nichol, John M.); Shulman, MD (Shulman, Michael D.); Harvey, SP (Harvey, Shannon P.); Umansky, V (Umansky, Vladimir); Rashba, EI (Rashba, Emmanuel I.); Yacoby, A (Yacoby, Amir); Halperin, BI (Halperin, Bertrand I.)

Source: PHYSICAL REVIEW B **Volume:** 95 **Issue:** 3 **Article Number:** 035306 **DOI:** 10.1103/PhysRevB.95.035306 **Published:** JAN 18 2017
Accession Number: WOS:000392073100005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harvey, Shannon		0000-0002-7272-3609

ISSN: 2469-9950
eISSN: 2469-9969

Record 9 of 43

Title: Spin-orbit coupling in quasi-one-dimensional Wigner crystals

Author(s): Kornich, V (Kornich, Viktoriia); Pedder, CJ (Pedder, Christopher J.); Schmidt, TL (Schmidt, Thomas L.)

Source: PHYSICAL REVIEW B **Volume:** 95 **Issue:** 4 **Article Number:** 045413 **DOI:** 10.1103/PhysRevB.95.045413 **Published:** JAN 17 2017
Accession Number: WOS:000392074700014

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Schmidt, Thomas	C-7394-2011	0000-0003-0382-1237
Schmidt, Thomas		0000-0002-1473-3913

ISSN: 2469-9950
eISSN: 2469-9969

Record 10 of 43

Title: Conversion from Single Photon to Single Electron Spin Using Electrically Controllable Quantum Dots

Author(s): Oiwa, A (Oiwa, Akira); Fujita, T (Fujita, Takafumi); Kiyama, H (Kiyama, Haruki); Allison, G (Allison, Giles); Ludwig, A (Ludwig, Arne); Wieck, AD (Wieck, Andreas D.); Tarucha, S (Tarucha, Seigo)

Source: JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN **Volume:** 86 **Issue:** 1 **Article Number:** 011008 **DOI:** 10.7566/JPSJ.86.011008 **Published:** JAN 15 2017
Accession Number: WOS:000391858100008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ludwig, Arne	G-2700-2013	0000-0002-2871-7789
Wieck, Andreas Dirk		0000-0001-9776-2922

ISSN: 0031-9015

Record 11 of 43

Title: Coherent manipulation of single electron spins with Landau-Zener sweeps

Author(s): Rancic, MJ (Rancic, Marko J.); Stepanenko, D (Stepanenko, Dimitrije)

Source: PHYSICAL REVIEW B **Volume:** 94 **Issue:** 24 **Article Number:** 241301 **DOI:** 10.1103/PhysRevB.94.241301 **Published:** DEC 12 2016
Accession Number: WOS:000390256100002
ISSN: 2469-9950
eISSN: 2469-9969

Record 12 of 43

Title: Signatures of Hyperfine, Spin-Orbit, and Decoherence Effects in a Pauli Spin Blockade

Author(s): Fujita, T (Fujita, T.); Stano, P (Stano, P.); Allison, G (Allison, G.); Morimoto, K (Morimoto, K.); Sato, Y (Sato, Y.); Larsson, M (Larsson, M.); Park, JH (Park, J. -H.); Ludwig, A (Ludwig, A.); Wieck, AD (Wieck, A. D.); Oiwa, A (Oiwa, A.); Tarucha, S (Tarucha, S.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 117 **Issue:** 20 **Article Number:** 206802 **DOI:** 10.1103/PhysRevLett.117.206802 **Published:** NOV 11 2016

Accession Number: WOS:000387544900009

PubMed ID: 27886503

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wieck, Andreas Dirk	C-5129-2009	0000-0001-9776-2922
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Sato, Yosuke		0000-0003-4871-8161
Ludwig, Arne		0000-0002-2871-7789

ISSN: 0031-9007

eISSN: 1079-7114

Record 13 of 43

Title: Fast spin information transfer between distant quantum dots using individual electrons

Author(s): Bertrand, B (Bertrand, B.); Hermelin, S (Hermelin, S.); Takada, S (Takada, S.); Yamamoto, M (Yamamoto, M.); Tarucha, S (Tarucha, S.); Ludwig, A (Ludwig, A.); Wieck, AD (Wieck, A. D.); Bauerle, C (Bauerle, C.); Meunier, T (Meunier, T.)

Source: Nature Nanotechnology **Volume:** 11 **Issue:** 8 **Pages:** 672-+ **DOI:** 10.1038/NNANO.2016.82 **Published:** AUG 2016

Accession Number: WOS:000381008300009

PubMed ID: 27240417

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wieck, Andreas Dirk	C-5129-2009	0000-0001-9776-2922
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Bauerle, Christopher	S-8973-2016	0000-0001-7393-0346
Takada, Shintaro	L-9336-2018	0000-0002-7831-585X
Yamamoto, Michihisa	E-6850-2017	0000-0001-9113-6461

ISSN: 1748-3387

eISSN: 1748-3395

Record 14 of 43

Title: Computer Simulation of Spin States of Electrons in Nanoscale Cavities in the Feynman Path Integrals Representation

Author(s): Shevkunov, SV (Shevkunov, S. V.)

Source: NANOTECHNOLOGIES IN RUSSIA **Volume:** 11 **Issue:** 7-8 **Pages:** 468-479 **DOI:** 10.1134/S1995078016040169 **Published:** JUL 2016

Accession Number: WOS:000410419100012

ISSN: 1995-0780

eISSN: 1995-0799

Record 15 of 43

Title: Spin-Orbit Coupling at the Level of a Single Electron

Author(s): Maisi, VF (Maisi, V. F.); Hofmann, A (Hofmann, A.); Roosli, M (Roeoesli, M.); Basset, J (Basset, J.); Reichl, C (Reichl, C.); Wegscheider, W (Wegscheider, W.); Ihn, T (Ihn, T.); Ensslin, K (Ensslin, K.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 116 **Issue:** 13 **Article Number:** 136803 **DOI:** 10.1103/PhysRevLett.116.136803 **Published:** MAR 30 2016

Accession Number: WOS:000373099500014

PubMed ID: 27081997

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Maisi, Ville	C-2950-2014	
Ihn, Thomas	A-4470-2018	0000-0002-5587-6953

ISSN: 0031-9007

eISSN: 1079-7114

Record 16 of 43

Title: Long-distance entanglement of spin qubits via quantum Hall edge states

Author(s): Yang, G (Yang, Guang); Hsu, CH (Hsu, Chen-Hsuan); Stano, P (Stano, Peter); Klinovaja, J (Klinovaja, Jelena); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 93 **Issue:** 7 **Article Number:** 075301 **DOI:** 10.1103/PhysRevB.93.075301 **Published:** FEB 1 2016

Accession Number: WOS:000369399200004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Klinovaja, Jelena	L-2510-2013	

Hsu, Chen-Hsuan	D-8051-2017	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Stano, Peter	C-3016-2013	0000-0001-5835-0765

ISSN: 2469-9950

eISSN: 2469-9969

Record 17 of 43

Title: Narrowing of the Overhauser field distribution by feedback-enhanced dynamic nuclear polarization

Author(s): Tenberg, S (Tenberg, S.); McNeil, RPG (McNeil, R. P. G.); Rubbert, S (Rubbert, S.); Bluhm, H (Bluhm, H.)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 19 **Article Number:** 195428 **DOI:** 10.1103/PhysRevB.92.195428 **Published:** NOV 24 2015

Accession Number: WOS:000365507500005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Tenberg, Stefanie	D-2773-2018	
Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254

ISSN: 1098-0121

eISSN: 1550-235X

Record 18 of 43

Title: Characterization of S-T+ transition dynamics via correlation measurements

Author(s): Dickel, C (Dickel, Christian); Foletti, S (Foletti, Sandra); Umansky, V (Umansky, Vladimir); Bluhm, H (Bluhm, Hendrik)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 12 **Article Number:** 125402 **DOI:** 10.1103/PhysRevB.92.125402 **Published:** SEP 4 2015

Accession Number: WOS:000360601200004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254

ISSN: 1098-0121

eISSN: 1550-235X

Record 19 of 43

Title: Fast long-distance control of spin qubits by photon-assisted cotunneling

Author(s): Stano, P (Stano, Peter); Klinovaja, J (Klinovaja, Jelena); Braakman, FR (Braakman, Floris R.); Vandersypen, LMK (Vandersypen, Lieven M. K.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 7 **Article Number:** 075302 **DOI:** 10.1103/PhysRevB.92.075302 **Published:** AUG 4 2015

Accession Number: WOS:000358931300002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073
Klinovaja, Jelena	L-2510-2013	
Stano, Peter	C-3016-2013	0000-0001-5835-0765
Braakman, Floris		0000-0003-3442-0110

ISSN: 1098-0121

eISSN: 1550-235X

Record 20 of 43

Title: Quenching of dynamic nuclear polarization by spin-orbit coupling in GaAs quantum dots

Author(s): Nichol, JM (Nichol, John M.); Harvey, SP (Harvey, Shannon P.); Shulman, MD (Shulman, Michael D.); Pal, A (Pal, Arijeet); Umansky, V (Umansky, Vladimir); Rashba, EI (Rashba, Emmanuel I.); Halperin, BI (Halperin, Bertrand I.); Yacoby, A (Yacoby, Amir)

Source: NATURE COMMUNICATIONS **Volume:** 6 **Article Number:** 7682 **DOI:** 10.1038/ncomms8682 **Published:** JUL 2015

Accession Number: WOS:000358858100026

PubMed ID: 26184854

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harvey, Shannon		0000-0002-7272-3609

ISSN: 2041-1723

Record 21 of 43

Title: Dispersively Detected Pauli Spin-Blockade in a Silicon Nanowire Field-Effect Transistor

Author(s): Betz, AC (Betz, A. C.); Wacquez, R (Wacquez, R.); Vinet, M (Vinet, M.); Jehl, X (Jehl, X.); Saraiva, AL (Saraiva, A. L.); Sanquer, M (Sanquer, M.); Ferguson, AJ (Ferguson, A. J.); Gonzalez-Zalba, MF (Gonzalez-Zalba, M. F.)

Source: NANO LETTERS **Volume:** 15 **Issue:** 7 **Pages:** 4622-4627 **DOI:** 10.1021/acs.nanolett.5b01306 **Published:** JUL 2015

Accession Number: WOS:000357964100058

PubMed ID: 26047255
ISSN: 1530-6984
eISSN: 1530-6992

Record 22 of 43

Title: Anisotropy of spin-orbit induced electron spin relaxation in [001] and [111] grown GaAs quantum dots

Author(s): Segarra, C (Segarra, C.); Planelles, J (Planelles, J.); Climente, JI (Climente, J. I.); Rajadell, F (Rajadell, F.)

Source: NEW JOURNAL OF PHYSICS **Volume:** 17 **Article Number:** 033014 **DOI:** 10.1088/1367-2630/17/3/033014 **Published:** MAR 6 2015

Accession Number: WOS:000352898900001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Climente, Juan	K-1699-2014	0000-0001-6984-6424
Segarra, Carlos		0000-0003-2979-1961

ISSN: 1367-2630

Record 23 of 43

Title: Interplay of spin-orbit and hyperfine interactions in dynamical nuclear polarization in semiconductor quantum dots

Author(s): Rancic, MJ (Rancic, Marko J.); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 24 **Article Number:** 245305 **DOI:** 10.1103/PhysRevB.90.245305 **Published:** DEC 22 2014

Accession Number: WOS:000346825600012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200

ISSN: 1098-0121
eISSN: 1550-235X

Record 24 of 43

Title: Single-spin manipulation in a double quantum dot in the field of a micromagnet

Author(s): Chesi, S (Chesi, Stefano); Wang, YD (Wang, Ying-Dan); Yoneda, J (Yoneda, Jun); Otsuka, T (Otsuka, Tomohiro); Tarucha, S (Tarucha, Seigo); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 23 **Article Number:** 235311 **DOI:** 10.1103/PhysRevB.90.235311 **Published:** DEC 15 2014

Accession Number: WOS:000346377400002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
TARUCHA, SEIGO	I-7030-2012	
Yoneda, Jun	C-6031-2017	0000-0003-0743-3696
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121
eISSN: 1550-235X

Record 25 of 43

Title: Conductance behavior in nanowires with spin-orbit interaction: A numerical study

Author(s): Rainis, D (Rainis, Diego); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 23 **Article Number:** 235415 **DOI:** 10.1103/PhysRevB.90.235415 **Published:** DEC 5 2014

Accession Number: WOS:000346609800004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121
eISSN: 1550-235X

Record 26 of 43

Title: High-Fidelity Single-Qubit Gates for Two-Electron Spin Qubits in GaAs

Author(s): Cerfontaine, P (Cerfontaine, Pascal); Botzem, T (Botzem, Tim); DiVincenzo, DP (DiVincenzo, David P.); Bluhm, H (Bluhm, Hendrik)

Source: PHYSICAL REVIEW LETTERS **Volume:** 113 **Issue:** 15 **Article Number:** 150501 **DOI:** 10.1103/PhysRevLett.113.150501 **Published:** OCT 7 2014

Accession Number: WOS:000342797100003

PubMed ID: 25375696

Author Identifiers:

Author	ResearcherID Number	ORCID Number
DiVincenzo, David	H-5952-2013	0000-0003-4332-645X

Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254

ISSN: 0031-9007

eISSN: 1079-7114

Record 27 of 43

Title: Exchange-based two-qubit gate for singlet-triplet qubits

Author(s): Wardrop, MP (Wardrop, Matthew P.); Doherty, AC (Doherty, Andrew C.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 4 **Article Number:** 045418 **DOI:** 10.1103/PhysRevB.90.045418 **Published:** JUL 21 2014

Accession Number: WOS:000339444100009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Doherty, Andrew	D-1816-2010	0000-0002-8069-7754

ISSN: 1098-0121

eISSN: 1550-235X

Record 28 of 43

Title: Two-qubit couplings of singlet-triplet qubits mediated by one quantum state

Author(s): Mehl, S (Mehl, Sebastian); Bluhm, H (Bluhm, Hendrik); DiVincenzo, DP (DiVincenzo, David P.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 4 **Article Number:** 045404 **DOI:** 10.1103/PhysRevB.90.045404 **Published:** JUL 9 2014

Accession Number: WOS:000338738600014

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254
DiVincenzo, David	H-5952-2013	0000-0003-4332-645X

ISSN: 2469-9950

eISSN: 2469-9969

Record 29 of 43

Title: Nuclear spin dynamics in double quantum dots: Multistability, dynamical polarization, criticality, and entanglement

Author(s): Schuetz, MJA (Schuetz, M. J. A.); Kessler, EM (Kessler, E. M.); Vandersypen, LMK (Vandersypen, L. M. K.); Cirac, JI (Cirac, J. I.); Giedke, G (Giedke, G.)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 19 **Article Number:** 195310 **DOI:** 10.1103/PhysRevB.89.195310 **Published:** MAY 27 2014

Accession Number: WOS:000336650500005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kessler, Eric Matthias	E-6981-2012	0000-0001-9959-538X
Cirac, Ignacio	A-9105-2017	0000-0003-3359-1743

ISSN: 1098-0121

eISSN: 1550-235X

Record 30 of 43

Title: Phonon-mediated decay of singlet-triplet qubits in double quantum dots

Author(s): Kornich, V (Kornich, Viktoriia); Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 8 **Article Number:** 085410 **DOI:** 10.1103/PhysRevB.89.085410 **Published:** FEB 12 2014

Accession Number: WOS:000332384300003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

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eISSN: 2469-9969

Record 31 of 43

Title: Theory of coherent dynamic nuclear polarization in quantum dots

Author(s): Neder, I (Neder, Izhar); Rudner, MS (Rudner, Mark S.); Halperin, BI (Halperin, Bertrand I.)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 8 **Article Number:** 085403 **DOI:** 10.1103/PhysRevB.89.085403 **Published:** FEB 4 2014

Accession Number: WOS:000332344200004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rudner, Mark	C-9325-2015	0000-0002-5150-6234

ISSN: 1098-0121

eISSN: 1550-235X

Record 32 of 43

Title: Driven Nonlinear Dynamics of Two Coupled Exchange-Only Qubits

Author(s): Pal, A (Pal, Arijeet); Rashba, EI (Rashba, Emmanuel I.); Halperin, BI (Halperin, Bertrand I.)

Source: PHYSICAL REVIEW X **Volume:** 4 **Issue:** 1 **Article Number:** 011012 **DOI:** 10.1103/PhysRevX.4.011012 **Published:** JAN 30 2014

Accession Number: WOS:000332155300003

ISSN: 2160-3308

Record 33 of 43

Title: Self-quenching of nuclear spin dynamics in the central spin problem

Author(s): Brataas, A (Brataas, Arne); Rashba, EI (Rashba, Emmanuel I.)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 3 **Article Number:** 035423 **DOI:** 10.1103/PhysRevB.89.035423 **Published:** JAN 21 2014

Accession Number: WOS:000332224500009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Brataas, Arne	C-6178-2014	0000-0003-0867-6323

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Record 34 of 43

Title: Phonon influence on the measurement of spin states in double quantum dots using the quantum point contact

Author(s): Marcinowski, L (Marcinowski, Lukasz); Roszak, K (Roszak, Katarzyna); Machnikowski, P (Machnikowski, Pawel); Krzyzosiak, M (Krzyzosiak, Mateusz)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 12 **Article Number:** 125303 **DOI:** 10.1103/PhysRevB.88.125303 **Published:** SEP 6 2013

Accession Number: WOS:000324049000005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Roszak, Katarzyna	E-9240-2015	
Machnikowski, Pawel	A-6106-2008	0000-0003-0349-1725

ISSN: 2469-9950

eISSN: 2469-9969

Record 35 of 43

Title: Temperature-dependent dynamical nuclear polarization bistabilities in double quantum dots in the spin-blockade regime

Author(s): Lunde, AM (Mathias Lunde, Anders); Lopez-Monis, C (Lopez-Monis, Carlos); Vasiliadou, IA (Vasiliadou, Ioanna A.); Bonilla, LL (Bonilla, Luis L.); Platero, G (Platero, Gloria)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 3 **Article Number:** 035317 **DOI:** 10.1103/PhysRevB.88.035317 **Published:** JUL 29 2013

Accession Number: WOS:000322575100005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Vasiliadou, Ioanna	B-3478-2017	0000-0003-4947-543X
Bonilla, Luis	B-6658-2008	0000-0002-7687-8595
Platero, Gloria	K-6732-2014	0000-0001-8610-0675

ISSN: 1098-0121

Record 36 of 43

Title: Spin noise spectroscopy of quantum dot molecules

Author(s): Roy, D (Roy, Dibyendu); Li, Y (Li, Yan); Greilich, A (Greilich, Alex); Pershin, YV (Pershin, Yuriy V.); Saxena, A (Saxena, Avadh); Sinitsyn, NA (Sinitsyn, Nikolai A.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 4 **Article Number:** 045320 **DOI:** 10.1103/PhysRevB.88.045320 **Published:** JUL 26 2013

Accession Number: WOS:000322529900003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Roy, Dibyendu	D-3286-2013	0000-0002-8966-8677
Li, Yan	B-1001-2012	
Greilich, Alex	A-8927-2009	
Dibyendu, Roy	E-6903-2017	

ISSN: 1098-0121

Record 37 of 43

Title: Preparation of nonequilibrium nuclear spin states in double quantum dots

Author(s): Gullans, M (Gullans, M.); Krich, JJ (Krich, J. J.); Taylor, JM (Taylor, J. M.); Halperin, BI (Halperin, B. I.); Lukin, MD (Lukin, M. D.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 3 **Article Number:** 035309 **DOI:** 10.1103/PhysRevB.88.035309 **Published:** JUL 15 2013

Accession Number: WOS:000321838600006

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Taylor, Jacob	B-7826-2011	0000-0003-0493-5594
Gullans, Michael		0000-0003-3974-2987

ISSN: 1098-0121

Record 38 of 43

Title: Optical Measurement and Modeling of Interactions between Two Hole Spins or Two Electron Spins in Coupled InAs Quantum Dots

Author(s): Greilich, A (Greilich, A.); Badescu, SC (Badescu, S. C.); Kim, D (Kim, D.); Bracker, AS (Bracker, A. S.); Gammon, D (Gammon, D.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 110 **Issue:** 11 **Article Number:** 117402 **DOI:** 10.1103/PhysRevLett.110.117402 **Published:** MAR 12 2013

Accession Number: WOS:000316172500028

PubMed ID: 25166576

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Greilich, Alex	A-8927-2009	

ISSN: 0031-9007

Record 39 of 43

Title: Prospects for Spin-Based Quantum Computing in Quantum Dots

Author(s): Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Edited by: Langer JS

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 4 **Book Series:** Annual Review of Condensed Matter Physics **Volume:** 4 **Pages:** 51-81 **DOI:** 10.1146/annurev-conmatphys-030212-184248 **Published:** 2013

Accession Number: WOS:000321694300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1947-5454

ISBN: 978-0-8243-5004-8

Record 40 of 43

Title: Tunable spin-dependent Andreev reflection in a four-terminal Aharonov-Bohm interferometer with coherent indirect coupling and Rashba spin-orbit interaction

Author(s): Bai, L (Bai, Long); Zhang, R (Zhang, Rong); Duan, CL (Duan, Chen-Long)

Source: NANOSCALE RESEARCH LETTERS **Volume:** 7 **Article Number:** 670 **DOI:** 10.1186/1556-276X-7-670 **Published:** DEC 10 2012

Accession Number: WOS:000315376900001

PubMed ID: 23228047

ISSN: 1931-7573

Record 41 of 43

Title: Controllable exchange coupling between two singlet-triplet qubits

Author(s): Li, R (Li, Rui); Hu, XD (Hu, Xuedong); You, JQ (You, J. Q.)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 20 **Article Number:** 205306 **DOI:** 10.1103/PhysRevB.86.205306 **Published:** NOV 6 2012

Accession Number: WOS:000310841900005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Li, Rui	I-2369-2012	0000-0003-1900-5998

ISSN: 1098-0121

Record 42 of 43

Title: Exchange-based CNOT gates for singlet-triplet qubits with spin-orbit interaction

Author(s): Klinovaja, J (Klinovaja, Jelena); Stepanenko, D (Stepanenko, Dimitrije); Halperin, BI (Halperin, Bertrand I.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 8 **Article Number:** 085423 **DOI:** 10.1103/PhysRevB.86.085423 **Published:** AUG 13 2012

Accession Number: WOS:000307441900012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Klinovaja, Jelena	L-2510-2013	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Title: Spectroscopy of Spin-Orbit Quantum Bits in Indium Antimonide Nanowires

Author(s): Nadj-Perge, S (Nadj-Perge, S.); Pribiag, VS (Pribiag, V. S.); van den Berg, JWG (van den Berg, J. W. G.); Zuo, K (Zuo, K.); Plissard, SR (Plissard, S. R.); Bakkers, EPAM (Bakkers, E. P. A. M.); Frolov, SM (Frolov, S. M.); Kouwenhoven, LP (Kouwenhoven, L. P.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 108 **Issue:** 16 **Article Number:** 166801 **DOI:** 10.1103/PhysRevLett.108.166801 **Published:** APR 19 2012

Accession Number: WOS:000302997500011

PubMed ID: 22680747

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Nadj-Perge, Stevan	G-4115-2013	0000-0002-2916-360X
Plissard, Sebastien	B-4502-2012	0000-0002-0769-5429
van den Berg, Johan	G-4510-2012	

ISSN: 0031-9007

Record 1 of 43

Title: Robust operating point for capacitively coupled singlet-triplet qubits

Author(s): Wolfe, MA (Wolfe, M. A.); Calderon-Vargas, FA (Calderon-Vargas, F. A.); Kestner, JP (Kestner, J. P.)

Source: PHYSICAL REVIEW B **Volume:** 96 **Issue:** 20 **Article Number:** 201307 **DOI:** 10.1103/PhysRevB.96.201307 **Published:** NOV 30 2017

Accession Number: WOS:000416547300002

ISSN: 2469-9950

eISSN: 2469-9969

Record 2 of 43

Title: Three-electron spin qubits

Author(s): Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 29 **Issue:** 39 **Article Number:** 393001 **DOI:** 10.1088/1361-648X/aa761f **Published:** OCT 4 2017

Accession Number: WOS:000408760400001

PubMed ID: 28562367

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Russ, Maximilian		0000-0001-9775-0323

ISSN: 0953-8984

eISSN: 1361-648X

Record 3 of 43

Title: Long-range entanglement for spin qubits via quantum Hall edge modes

Author(s): Elman, SJ (Elman, Samuel J.); Bartlett, SD (Bartlett, Stephen D.); Doherty, AC (Doherty, Andrew C.)

Source: PHYSICAL REVIEW B **Volume:** 96 **Issue:** 11 **Article Number:** 115407 **DOI:** 10.1103/PhysRevB.96.115407 **Published:** SEP 5 2017

Accession Number: WOS:000409254000008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Doherty, Andrew	D-1816-2010	0000-0002-8069-7754
Bartlett, Stephen	A-4163-2008	0000-0003-4387-670X

ISSN: 2469-9950

eISSN: 2469-9969

Record 4 of 43

Title: Energy spectrum, exchange interaction, and gate crosstalk in a system with a pair of double quantum dots: A molecular-orbital calculation

Author(s): Yang, XC (Yang, Xu-Chen); Wang, X (Wang, Xin)

Source: PHYSICAL REVIEW A **Volume:** 95 **Issue:** 5 **Article Number:** 052325 **DOI:** 10.1103/PhysRevA.95.052325 **Published:** MAY 12 2017

Accession Number: WOS:000401189500005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wang, Xin	F-5509-2011	0000-0003-2971-5088
Yang, Xu-Chen	O-3405-2017	0000-0001-5058-8496

ISSN: 2469-9926

eISSN: 2469-9934

Record 5 of 43

Title: Robust universal gates for quantum-dot spin qubits using tunable adiabatic passages

Author(s): Gong, B (Gong, Bo); Wang, L (Wang, Li); Tu, T (Tu, Tao); Li, CF (Li, Chuan-Feng); Guo, GC (Guo, Guang-Can)

Source: PHYSICAL REVIEW A **Volume:** 94 **Issue:** 3 **Article Number:** 032311 **DOI:** 10.1103/PhysRevA.94.032311 **Published:** SEP 12 2016

Accession Number: WOS:000383136800001

ISSN: 2469-9926

eISSN: 2469-9934

Record 6 of 43

Title: Implementing of Quantum Cloning with Spatially Separated Quantum Dot Spins

Author(s): Wen, JJ (Wen, Jing-Ji); Yeon, KH (Yeon, Kyu-Hwang); Du, X (Du, Xin); Lv, J (Lv, Jia); Wang, M (Wang, Ming); Wang, HF (Wang, Hong-Fu); Zhang, S (Zhang, Shou)

Source: INTERNATIONAL JOURNAL OF THEORETICAL PHYSICS **Volume:** 55 **Issue:** 7 **Pages:** 3088-3096 **DOI:** 10.1007/s10773-016-2939-5 **Published:** JUL 2016

Accession Number: WOS:000378746600002

ISSN: 0020-7748
eISSN: 1572-9575

Record 7 of 43

Title: Geometric phase of two-qubit system in dephasing environment

Author(s): Cai, XY (Cai, Xiaoya); Pan, H (Pan, Hui); Wang, ZS (Wang, Z. S.)

Source: INTERNATIONAL JOURNAL OF MODERN PHYSICS B **Volume:** 29 **Issue:** 32 **Article Number:** 1550236 **DOI:** 10.1142/S0217979215502367 **Published:** DEC 30 2015

Accession Number: WOS:000367296800009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Pan, Hui	A-2702-2009	0000-0002-6515-4970

ISSN: 0217-9792
eISSN: 1793-6578

Record 8 of 43

Title: Capacitively coupled singlet-triplet qubits in the double charge resonant regime

Author(s): Srinivasa, V (Srinivasa, V.); Taylor, JM (Taylor, J. M.)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 23 **Article Number:** 235301 **DOI:** 10.1103/PhysRevB.92.235301 **Published:** DEC 1 2015

Accession Number: WOS:000365774000005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Taylor, Jacob	B-7826-2011	0000-0003-0493-5594

ISSN: 2469-9950
eISSN: 2469-9969

Record 9 of 43

Title: Exact CNOT gates with a single nonlocal rotation for quantum-dot qubits

Author(s): Pal, A (Pal, Arijeet); Rashba, EI (Rashba, Emmanuel I.); Halperin, BI (Halperin, Bertrand I.)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 12 **Article Number:** 125409 **DOI:** 10.1103/PhysRevB.92.125409 **Published:** SEP 9 2015

Accession Number: WOS:000360885500006

ISSN: 2469-9950
eISSN: 2469-9969

Record 10 of 43

Title: Asymmetric resonant exchange qubit under the influence of electrical noise

Author(s): Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 23 **Article Number:** 235411 **DOI:** 10.1103/PhysRevB.91.235411 **Published:** JUN 9 2015

Accession Number: WOS:000355825700003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Russ, Maximilian		0000-0001-9775-0323

ISSN: 1098-0121
eISSN: 1550-235X

Record 11 of 43

Title: Charge-noise tolerant exchange gates of singlet-triplet qubits in asymmetric double quantum dots

Author(s): Hiltunen, T (Hiltunen, Tuukka); Bluhm, H (Bluhm, Hendrik); Mehl, S (Mehl, Sebastian); Harju, A (Harju, Ari)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 7 **Article Number:** 075301 **DOI:** 10.1103/PhysRevB.91.075301 **Published:** FEB 3 2015

Accession Number: WOS:000348873800002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harju, Ari	C-2828-2009	0000-0002-2233-2896
Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254

ISSN: 1098-0121
eISSN: 1550-235X

Record 12 of 43

Title: Directly accessible entangling gates for capacitively coupled singlet-triplet qubits

Author(s): Calderon-Vargas, FA (Calderon-Vargas, F. A.); Kestner, JP (Kestner, J. P.)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 3 **Article Number:** 035301 **DOI:** 10.1103/PhysRevB.91.035301 **Published:** JAN 6 2015

Accession Number: WOS:000348703700006

ISSN: 2469-9950

eISSN: 2469-9969

Record 13 of 43

Title: Hybrid Spin and Valley Quantum Computing with Singlet-Triplet Qubits

Author(s): Rohling, N (Rohling, Niklas); Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW LETTERS **Volume:** 113 **Issue:** 17 **Article Number:** 176801 **DOI:** 10.1103/PhysRevLett.113.176801 **Published:** OCT 21 2014

Accession Number: WOS:000344052700008

PubMed ID: 25379928

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Russ, Maximilian		0000-0001-9775-0323
Rohling, Niklas		0000-0002-2067-5852

ISSN: 0031-9007

eISSN: 1079-7114

Record 14 of 43

Title: Capacitative coupling of singlet-triplet qubits in different interqubit geometries

Author(s): Hiltunen, T (Hiltunen, Tuukka); Harju, A (Harju, Ari)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 12 **Article Number:** 125303 **DOI:** 10.1103/PhysRevB.90.125303 **Published:** SEP 5 2014

Accession Number: WOS:000341259900006

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harju, Ari	C-2828-2009	0000-0002-2233-2896

ISSN: 1098-0121

eISSN: 1550-235X

Record 15 of 43

Title: Maximal tripartite entanglement between singlet-triplet qubits in quantum dots

Author(s): Hiltunen, T (Hiltunen, Tuukka); Harju, A (Harju, Ari)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 11 **Article Number:** 115322 **DOI:** 10.1103/PhysRevB.89.115322 **Published:** MAR 28 2014

Accession Number: WOS:000333554600005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harju, Ari	C-2828-2009	0000-0002-2233-2896

ISSN: 1098-0121

eISSN: 1550-235X

Record 16 of 43

Title: Six-electron semiconductor double quantum dot qubits

Author(s): Nielsen, E (Nielsen, Erik); Barnes, E (Barnes, Edwin); Kestner, JP (Kestner, J. P.); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 19 **Article Number:** 195131 **DOI:** 10.1103/PhysRevB.88.195131 **Published:** NOV 18 2013

Accession Number: WOS:000327158600002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Barnes, Edwin	A-1583-2013	
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X

ISSN: 1098-0121

eISSN: 1550-235X

Record 17 of 43

Title: Non-adiabatic charge state transitions in singlet-triplet qubits

Author(s): Hiltunen, T (Hiltunen, Tuukka); Ritala, J (Ritala, Juha); Siro, T (Siro, Topi); Harju, A (Harju, Ari)

Source: NEW JOURNAL OF PHYSICS **Volume:** 15 **Article Number:** 103015 **DOI:** 10.1088/1367-2630/15/10/103015 **Published:** OCT 17 2013

Accession Number: WOS:000325748300001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Harju, Ari	C-2828-2009	0000-0002-2233-2896

ISSN: 1367-2630

Record 18 of 43

Title: Coupling Spin Qubits via Superconductors

Author(s): Leijnse, M (Leijnse, Martin); Flensberg, K (Flensberg, Karsten)

Source: PHYSICAL REVIEW LETTERS **Volume:** 111 **Issue:** 6 **Article Number:** 060501 **DOI:** 10.1103/PhysRevLett.111.060501 **Published:** AUG 6 2013

Accession Number: WOS:000322786500001

PubMed ID: 23971543

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Leijnse, Martin	D-3116-2015	0000-0003-3639-8594
Flensberg, Karsten	N-4718-2014	0000-0002-8311-0103

ISSN: 0031-9007

Record 19 of 43

Title: Physical optimization of quantum error correction circuits with spatially separated quantum dot spins

Author(s): Wang, HF (Wang, Hong-Fu); Zhu, AD (Zhu, Ai-Dong); Zhang, S (Zhang, Shou)

Source: OPTICS EXPRESS **Volume:** 21 **Issue:** 10 **Pages:** 12484-12494 **DOI:** 10.1364/OE.21.012484 **Published:** MAY 20 2013

Accession Number: WOS:000319339600083

PubMed ID: 23736467

ISSN: 1094-4087

Record 20 of 43

Title: Efficient Quantum Circuit for Encoding and Decoding of the [[8,3,5]] Stabilizer Code

Author(s): Dong, P (Dong, Ping); Liu, J (Liu, Jun); Cao, ZL (Cao, Zhuo-Liang)

Source: INTERNATIONAL JOURNAL OF THEORETICAL PHYSICS **Volume:** 52 **Issue:** 4 **Pages:** 1274-1281 **DOI:** 10.1007/s10773-012-1442-x **Published:** APR 2013

Accession Number: WOS:000315443400022

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dong, Ping	H-2356-2016	

ISSN: 0020-7748

Record 21 of 43

Title: Controllable exchange coupling between two singlet-triplet qubits

Author(s): Li, R (Li, Rui); Hu, XD (Hu, Xuedong); You, JQ (You, J. Q.)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 20 **Article Number:** 205306 **DOI:** 10.1103/PhysRevB.86.205306 **Published:** NOV 6 2012

Accession Number: WOS:000310841900005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Li, Rui	I-2369-2012	0000-0003-1900-5998

ISSN: 1098-0121

Record 22 of 43

Title: Universal quantum computing with spin and valley states

Author(s): Rohling, N (Rohling, Niklas); Burkard, G (Burkard, Guido)

Source: NEW JOURNAL OF PHYSICS **Volume:** 14 **Article Number:** 083008 **DOI:** 10.1088/1367-2630/14/8/083008 **Published:** AUG 10 2012

Accession Number: WOS:000307439500001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Rohling, Niklas		0000-0002-2067-5852

ISSN: 1367-2630

Record 23 of 43

Title: Long-Distance Spin-Spin Coupling via Floating Gates

Author(s): Trifunovic, L (Trifunovic, Luka); Dial, O (Dial, Oliver); Trif, M (Trif, Mircea); Wootton, JR (Wootton, James R.); Abebe, R (Abebe, Rediet); Yacoby, A (Yacoby, Amir); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW X **Volume:** 2 **Issue:** 1 **Article Number:** 011006 **DOI:** 10.1103/PhysRevX.2.011006 **Published:** JAN 26 2012

Accession Number: WOS:000310510100001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 2160-3308

Record 24 of 43

Title: Configuration interaction calculations of the controlled phase gate in double quantum dot qubits

Author(s): Nielsen, E (Nielsen, Erik); Muller, RP (Muller, Richard P.); Carroll, MS (Carroll, Malcolm S.)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 3 **Article Number:** 035319 **DOI:** 10.1103/PhysRevB.85.035319 **Published:** JAN 25 2012

Accession Number: WOS:000299871000004

ISSN: 1098-0121

Record 25 of 43

Title: Electrically controlled quantum gates for two-spin qubits in two double quantum dots

Author(s): Ramon, G (Ramon, Guy)

Source: PHYSICAL REVIEW B **Volume:** 84 **Issue:** 15 **Article Number:** 155329 **DOI:** 10.1103/PhysRevB.84.155329 **Published:** OCT 31 2011

Accession Number: WOS:000296853700013

ISSN: 1098-0121

Record 26 of 43

Title: Low-noise conditional operation of singlet-triplet coupled quantum dot qubits

Author(s): Yang, S (Yang, Shuo); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW B **Volume:** 84 **Issue:** 12 **Article Number:** 121306 **DOI:** 10.1103/PhysRevB.84.121306 **Published:** SEP 23 2011

Accession Number: WOS:000295163300002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Yang, Shuo	D-1372-2011	0000-0001-9733-8566
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X

ISSN: 1098-0121

Record 27 of 43

Title: Low-Density Quantum Dot Molecules by Selective Etching Using in Droplet as a Mask

Author(s): Lee, J (Lee, Jihoon); Wang, ZMM (Wang, Zhiming M.); Hirono, Y (Hirono, Yusuke); Dorogan, VG (Dorogan, Vitaliy G.); Mazur, YI (Mazur, Yuriy I.); Kim, ES (Kim, Eun-Soo); Koo, SM (Koo, Sang-Mo); Park, S (Park, Seunghyun); Song, S (Song, Sangmin); Salamo, GJ (Salamo, Gregory J.)

Source: IEEE TRANSACTIONS ON NANOTECHNOLOGY **Volume:** 10 **Issue:** 3 **Pages:** 600-605 **DOI:** 10.1109/TNANO.2010.2056695 **Published:** MAY 2011

Accession Number: WOS:000292963500035

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wang, Zhiming	Q-1031-2015	
Dorogan, Vitaliy	D-7019-2012	
Lee, Jihoon		0000-0002-8768-8586

ISSN: 1536-125X

eISSN: 1941-0085

Record 28 of 43

Title: Harnessing the GaAs quantum dot nuclear spin bath for quantum control

Author(s): Ribeiro, H (Ribeiro, Hugo); Petta, JR (Petta, J. R.); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 11 **Article Number:** 115445 **DOI:** 10.1103/PhysRevB.82.115445 **Published:** SEP 24 2010

Accession Number: WOS:000282125700005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Petta, Jason	J-6663-2013	0000-0002-6416-0789

ISSN: 1098-0121

Record 29 of 43

Title: Various Quantum- and Nano-Structures by III-V Droplet Epitaxy on GaAs Substrates

Author(s): Lee, JH (Lee, J. H.); Wang, ZM (Wang, Zh. M.); Kim, ES (Kim, E. S.); Kim, NY (Kim, N. Y.); Park, SH (Park, S. H.); Salamo, GJ (Salamo, G. J.)

Source: NANOSCALE RESEARCH LETTERS **Volume:** 5 **Issue:** 2 **Pages:** 308-314 **DOI:** 10.1007/s11671-009-9481-9 **Published:** FEB 2010

Accession Number: WOS:000273812500008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wang, Zhiming	B-6320-2009	
Wang, Zhiming	Q-1031-2015	
Lee, Jihoon		0000-0002-8768-8586

ISSN: 1931-7573

Record 30 of 43

Title: Implementation of Quantum Fourier Transform and Its Applications via Quantum-Dot Spins and Microcavity

Author(s): Dong, P (Dong Ping); Zheng, XH (Zheng Xiao-Hu); Zhang, G (Zhang Gang); Cao, ZL (Cao Zhuo-Liang)

Source: COMMUNICATIONS IN THEORETICAL PHYSICS **Volume:** 52 **Issue:** 3 **Pages:** 425-430 **Published:** SEP 2009

Accession Number: WOS:000270151300009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dong, Ping	H-2356-2016	

ISSN: 0253-6102

Record 31 of 43

Title: On the complex behavior of strain relaxation in (In,Ga)As/GaAs(001) quantum dot molecules

Author(s): Hanke, M (Hanke, M.); Dubslaff, M (Dubslaff, M.); Schmidbauer, M (Schmidbauer, M.); Wang, ZM (Wang, Zh. M.); Mazur, YI (Mazur, Yu. I.); Lytvyn, PM (Lytvyn, P. M.); Lee, JH (Lee, J. H.); Salamo, GJ (Salamo, G. J.)

Source: APPLIED PHYSICS LETTERS **Volume:** 95 **Issue:** 2 **Article Number:** 023103 **DOI:** 10.1063/1.3176409 **Published:** JUL 13 2009

Accession Number: WOS:000268089200079

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Lytvyn, Peter	A-7372-2015	
Lytvyn, Peter	G-9054-2018	0000-0002-0131-9860
Wang, Zhiming	B-6320-2009	
Wang, Zhiming	Q-1031-2015	
Hanke, Michael	S-9246-2017	
Lee, Jihoon		0000-0002-8768-8586

ISSN: 0003-6951

Record 32 of 43

Title: The Control on Size and Density of InAs QDs by Droplet Epitaxy (April 2009)

Author(s): Lee, JH (Lee, Jihoon H.); Wang, ZMM (Wang, Zhiming M.); Salamo, GJ (Salamo, Gregory J.)

Source: IEEE TRANSACTIONS ON NANOTECHNOLOGY **Volume:** 8 **Issue:** 4 **Pages:** 431-436 **DOI:** 10.1109/TNANO.2009.2021654 **Published:** JUL 2009

Accession Number: WOS:000268170900002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wang, Zhiming	B-6320-2009	
Wang, Zhiming	Q-1031-2015	
Lee, Jihoon		0000-0002-8768-8586

ISSN: 1536-125X

eISSN: 1941-0085

Record 33 of 43

Title: Parity-measurement-based entanglement concentration

Author(s): Cao, ZL (Cao, Zhuo-Liang); Dong, P (Dong, Ping)

Source: PHYSICA B-CONDENSED MATTER **Volume:** 404 **Issue:** 14-15 **Pages:** 1917-1919 **DOI:** 10.1016/j.physb.2009.03.011 **Published:** JUL 1 2009

Accession Number: WOS:000267408000009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dong, Ping	H-2356-2016	

ISSN: 0921-4526

eISSN: 1873-2135

Record 34 of 43

Title: Tunable resonant tunneling through a system of capacitively coupled double quantum dots

Author(s): Yuan, RY (Yuan, R. Y.); Wang, RZ (Wang, R. Z.); Yan, H (Yan, H.)

Source: PHYSICA E-LOW-DIMENSIONAL SYSTEMS & NANOSTRUCTURES **Volume:** 41 **Issue:** 4 **Pages:** 558-563 **DOI:** 10.1016/j.physe.2008.10.012 **Published:** FEB 2009

Accession Number: WOS:000264471700009

ISSN: 1386-9477

Record 35 of 43

Title: Discrete quantum Fourier transform in coupled semiconductor double quantum dot molecules

Author(s): Dong, P (Dong, Ping); Yang, M (Yang, Ming); Cao, ZL (Cao, Zhuo-Liang)

Source: PHYSICS LETTERS A **Volume:** 373 **Issue:** 1 **Pages:** 30-32 **DOI:** 10.1016/j.physleta.2008.11.005 **Published:** DEC 22 2008

Accession Number: WOS:000261795700007

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dong, Ping	H-2356-2016	

ISSN: 0375-9601

Record 36 of 43

Title: Dispersive coupling between the superconducting transmission line resonator and the double quantum dots

Author(s): Guo, GP (Guo, Guo-Ping); Zhang, H (Zhang, Hui); Hu, Y (Hu, Yong); Tu, T (Tu, Tao); Guo, GC (Guo, Guang-Can)

Source: PHYSICAL REVIEW A **Volume:** 78 **Issue:** 2 **Article Number:** 020302 **DOI:** 10.1103/PhysRevA.78.020302 **Part:** A **Published:** AUG 2008

Accession Number: WOS:000259263400003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Guo, GuoPing	H-1928-2015	
Guo, Guo-Ping		0000-0002-2179-9507

ISSN: 1050-2947

Record 37 of 43

Title: Dynamical polarization processes in double quantum dots coupled in series

Author(s): Michalek, G (Michalek, G.); Bulka, BR (Bulka, B. R.)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 20 **Issue:** 27 **Article Number:** 275244 **DOI:** 10.1088/0953-8984/20/27/275244 **Published:** JUL 9 2008

Accession Number: WOS:000257178300046

PubMed ID: 21694405

ISSN: 0953-8984

Record 38 of 43

Title: Evolution of InGaAs quantum dot molecules

Author(s): Lee, JH (Lee, J. H.); Sablon, K (Sablon, K.); Wang, ZM (Wang, Zh. M.); Salamo, GJ (Salamo, G. J.)

Source: JOURNAL OF APPLIED PHYSICS **Volume:** 103 **Issue:** 5 **Article Number:** 054301 **DOI:** 10.1063/1.2890149 **Published:** MAR 1 2008

Accession Number: WOS:000254025000074

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wang, Zhiming	B-6320-2009	
Wang, Zhiming	Q-1031-2015	
Lee, Jihoon		0000-0002-8768-8586

ISSN: 0021-8979

eISSN: 1089-7550

Record 39 of 43

Title: Eliminating interactions between non-neighboring qubits in the preparation of cluster states in quantum molecules

Author(s): Guo, GP (Guo, Guo-Ping); Hao, XJ (Hao, Xiao-Jie); Tu, T (Tu, Tao); Zhu, ZC (Zhu, Zhi-Cheng); Guo, GC (Guo, Guang-Can)

Source: EUROPEAN PHYSICAL JOURNAL B **Volume:** 61 **Issue:** 2 **Pages:** 141-146 **DOI:** 10.1140/epjb/e2008-00053-9 **Published:** JAN 2008

Accession Number: WOS:000253216400004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Hao, Xiaojie	B-2601-2014	
Guo, GuoPing	H-1928-2015	
Hao, Xiaojie	D-8824-2013	
Guo, Guo-Ping		0000-0002-2179-9507

ISSN: 1434-6028

Record 40 of 43

Title: Controlled-NOT gate for multiparticle qubits and topological quantum computation based on parity measurements

Author(s): Zilberberg, O (Zilberberg, Oded); Braunecker, B (Braunecker, Bernd); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW A **Volume:** 77 **Issue:** 1 **Article Number:** 012327 **DOI:** 10.1103/PhysRevA.77.012327 **Published:** JAN 2008

Accession Number: WOS:000252862000059

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zilberberg, Oded	L-6474-2013	0000-0002-1759-4920
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1050-2947

Record 41 of 43

Title: General quantum phase estimation and calibration of a timepiece in a quantum dot system

Author(s): Dong, P (Dong, Ping); Cao, ZL (Cao, Zhuo-Liang)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 19 **Issue:** 37 **Article Number:** 376216 **DOI:** 10.1088/0953-8984/19/37/376216 **Published:** SEP 19 2007

Accession Number: WOS:000249255300041

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Dong, Ping	H-2356-2016	

ISSN: 0953-8984

eISSN: 1361-648X

Record 42 of 43

Title: Quantum computation and Bell-state measurements with double-dot molecules

Author(s): Zhang, H (Zhang, Hui); Guo, GP (Guo, Guo-Ping); Tu, T (Tu, Tao); Guo, GC (Guo, Guang-Can)

Source: PHYSICAL REVIEW A **Volume:** 76 **Issue:** 1 **Article Number:** 012335 **DOI:** 10.1103/PhysRevA.76.012335 **Published:** JUL 2007

Accession Number: WOS:000248486600073

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Guo, GuoPing	H-1928-2015	
Guo, Guo-Ping		0000-0002-2179-9507

ISSN: 1050-2947

Record 43 of 43

Title: One-step preparation of cluster states in quantum-dot molecules

Author(s): Guo, GP (Guo, Guo-Ping); Zhang, H (Zhang, Hui); Tu, T (Tu, Tao); Guo, GC (Guo, Guang-Can)

Source: PHYSICAL REVIEW A **Volume:** 75 **Issue:** 5 **Article Number:** 050301 **DOI:** 10.1103/PhysRevA.75.050301 **Published:** MAY 2007

Accession Number: WOS:000246890400002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Guo, GuoPing	H-1928-2015	
Guo, Guo-Ping		0000-0002-2179-9507

ISSN: 1050-2947

Record 1 of 37

Title: Interactions between H-bonded [CuII3((3)-OH)] triangles; a combined magnetic susceptibility and EPR study

Author(s): Mathivathanan, L (Mathivathanan, Logesh); Boudalis, AK (Boudalis, Athanassios K.); Turek, P (Turek, Philippe); Pissas, M (Pissas, Michael); Sanakis, Y (Sanakis, Yiannis); Raptis, RG (Raptis, Raphael G.)

Source: PHYSICAL CHEMISTRY CHEMICAL PHYSICS **Volume:** 20 **Issue:** 25 **Pages:** 17234-17244 **DOI:** 10.1039/c8cp02643b **Published:** JUL 7 2018

Accession Number: WOS:000436571800038

PubMed ID: 29901059

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Raptis, Raphael	D-2833-2009	0000-0002-9522-0369
Boudalis, Athanassios		0000-0002-8797-1170
Mathivathanan, Logesh		0000-0002-3666-885X

ISSN: 1463-9076

eISSN: 1463-9084

Record 2 of 37

Title: Experimental and theoretical investigations on magneto-structural correlation in trinuclear copper(II) hydroxido propellers

Author(s): Rigamonti, L (Rigamonti, Luca); Forni, A (Forni, Alessandra); Sironi, M (Sironi, Maurizio); Ponti, A (Ponti, Alessandro); Ferretti, AM (Ferretti, Anna M.); Baschieri, C (Baschieri, Carlo); Pasini, A (Pasini, Alessandro)

Source: POLYHEDRON **Volume:** 145 **Pages:** 22-34 **DOI:** 10.1016/j.poly.2018.01.028 **Published:** MAY 1 2018

Accession Number: WOS:000429394200003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ferretti, Anna Maria	E-6861-2010	0000-0002-7373-7965
Forni, Alessandra	B-4564-2009	0000-0002-5020-5544
Rigamonti, Luca		0000-0002-9875-9765

ISSN: 0277-5387

Record 3 of 37

Title: Electric nonadiabatic geometric entangling gates on spin qubits

Author(s): Mousolou, VA (Mousolou, Vahid Azimi)

Source: PHYSICAL REVIEW A **Volume:** 96 **Issue:** 1 **Article Number:** 012307 **DOI:** 10.1103/PhysRevA.96.012307 **Published:** JUL 5 2017

Accession Number: WOS:000405017200013

ISSN: 2469-9926

eISSN: 2469-9934

Record 4 of 37

Title: Single-shot realization of nonadiabatic holonomic quantum gates in decoherence-free subspaces

Author(s): Zhao, PZ (Zhao, P. Z.); Xu, GF (Xu, G. F.); Ding, QM (Ding, Q. M.); Sjoqvist, E (Sjoqvist, Erik); Tong, DM (Tong, D. M.)

Source: PHYSICAL REVIEW A **Volume:** 95 **Issue:** 6 **Article Number:** 062310 **DOI:** 10.1103/PhysRevA.95.062310 **Published:** JUN 6 2017

Accession Number: WOS:000402794000002

ISSN: 2469-9926

eISSN: 2469-9934

Record 5 of 37

Title: Redox-Induced Gating of the Exchange Interactions in a Single Organic Diradical

Author(s): Gaudenzi, R (Gaudenzi, Rocco); de Bruijckere, J (de Bruijckere, Joeri); Reta, D (Reta, Daniel); Moreira, IDPR (Moreira, Iberio de P. R.); Rovira, C (Rovira, Concepcio); Veciana, J (Veciana, Jaume); van der Zant, HSJ (van der Zant, Herre S. J.); Burzuri, E (Burzuri, Enrique)

Source: ACS NANO **Volume:** 11 **Issue:** 6 **Pages:** 5879-5883 **DOI:** 10.1021/acsnano.7b01578 **Published:** JUN 2017

Accession Number: WOS:000404808000067

PubMed ID: 28494146

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Reta, Daniel	H-6853-2015	0000-0003-0000-9892
ROVIRA, Concepcio*	F-3155-2011	0000-0002-2365-9479
Veciana, Jaume		0000-0003-1023-9923
Gaudenzi, Rocco		0000-0002-0762-6351
Burzuri, Enrique		0000-0001-7906-7192

ISSN: 1936-0851

eISSN: 1936-086X

Record 6 of 37

Title: Spin-electric Berry phase shift in triangular molecular magnets

Author(s): Mousolou, VA (Mousolou, Vahid Azimi); Canali, CM (Canali, C. M.); Sjoqvist, E (Sjoqvist, Erik)

Source: PHYSICAL REVIEW B **Volume:** 94 **Issue:** 23 **Article Number:** 235423 **DOI:** 10.1103/PhysRevB.94.235423 **Published:** DEC 20 2016

Accession Number: WOS:000394546100004

ISSN: 2469-9950

eISSN: 2469-9969

Record 7 of 37

Title: Magnetoelectricity of single molecular toroics: The Dy-4 ring cluster

Author(s): Popov, AI (Popov, A. I.); Plokhov, DI (Plokhov, D. I.); Zvezdin, AK (Zvezdin, A. K.)

Source: PHYSICAL REVIEW B **Volume:** 94 **Issue:** 18 **Article Number:** 184408 **DOI:** 10.1103/PhysRevB.94.184408 **Published:** NOV 9 2016

Accession Number: WOS:000387534600002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Zvezdin, Anatoly	K-2072-2013	
Plokhov, Dmitry	I-2141-2018	
Zvezdin, Anatoly	K-8897-2017	

ISSN: 2469-9950

eISSN: 2469-9969

Record 8 of 37

Title: Field-dependent superradiant quantum phase transition of molecular magnets in microwave cavities

Author(s): Stepanenko, D (Stepanenko, Dimitrije); Trif, M (Trif, Mircea); Tsyplyatyev, O (Tsyplyatyev, Oleksandr); Loss, D (Loss, Daniel)

Source: SEMICONDUCTOR SCIENCE AND TECHNOLOGY **Volume:** 31 **Issue:** 9 **Article Number:** 094003 **DOI:** 10.1088/0268-1242/31/9/094003 **Published:** SEP 2016

Accession Number: WOS:000383973800001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 0268-1242

eISSN: 1361-6641

Record 9 of 37

Title: [CrF((O2CBu)-Bu-t)(2)](9): Synthesis and Characterization of a Regular Homometallic Ring with an Odd Number of Metal Centers and Electrons

Author(s): Woolfson, RJ (Woolfson, Robert J.); Timco, GA (Timco, Grigore A.); Chiesa, A (Chiesa, Alessandro); Vitorica-Yrezabal, IJ (Vitorica-Yrezabal, Inigo J.); Tuna, F (Tuna, Floriana); Guidi, T (Guidi, Tatiana); Pavarini, E (Pavarini, Eva); Santini, P (Santini, Paolo); Carretta, S (Carretta, Stefano); Winpenny, REP (Winpenny, Richard E. P.)

Source: ANGEWANDTE CHEMIE-INTERNATIONAL EDITION **Volume:** 55 **Issue:** 31 **Pages:** 8856-8859 **DOI:** 10.1002/anie.201601734 **Published:** JUL 25 2016

Accession Number: WOS:000383253700007

PubMed ID: 27294807

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Pavarini, Eva	F-3156-2011	0000-0003-0860-8558
Guidi, Tatiana	H-6280-2011	0000-0001-9320-2960
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Carretta, Stefano		0000-0002-2536-1326
Winpenny, Richard		0000-0002-7101-3963
Chiesa, Alessandro		0000-0003-2955-3998

ISSN: 1433-7851

eISSN: 1521-3773

Record 10 of 37

Title: Spin Chirality of Cu-3 and V-3 Nanomagnets. 1. Rotation Behavior of Vector Chirality, Scalar Chirality, and Magnetization in the Rotating Magnetic Field, Magnetochiral Correlations

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: INORGANIC CHEMISTRY **Volume:** 55 **Issue:** 9 **Pages:** 4078-4090 **DOI:** 10.1021/acs.inorgchem.5b02202 **Published:** MAY 2 2016

Accession Number: WOS:000375519700004

PubMed ID: 27070665

ISSN: 0020-1669

eISSN: 1520-510X

Record 11 of 37

Title: Spin Chirality of Cu-3 and V-3 Nanomagnets. 2. Frustration, Temperature, and Distortion Dependence of Spin Chiralities and Magnetization in the Rotating and Tilted Magnetic Fields

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: INORGANIC CHEMISTRY **Volume:** 55 **Issue:** 9 **Pages:** 4091-4109 **DOI:** 10.1021/acs.inorgchem.5b02204 **Published:** MAY 2 2016

Accession Number: WOS:000375519700005

PubMed ID: 27070817

ISSN: 0020-1669

eISSN: 1520-510X

Record 12 of 37

Title: A Spin-Frustrated Trinuclear Copper Complex Based on Triaminoguanidine with an Energetically Well-Separated Degenerate Ground State

Author(s): Spielberg, ET (Spielberg, Eike T.); Gilb, A (Gilb, Aksana); Plaul, D (Plaul, Daniel); Geibig, D (Geibig, Daniel); Hornig, D (Hornig, David); Schuch, D (Schuch, Dirk); Buchholz, A (Buchholz, Axel); Ardavan, A (Ardavan, Arzhang); Plass, W (Plass, Winfried)

Source: INORGANIC CHEMISTRY **Volume:** 54 **Issue:** 7 **Pages:** 3432-3438 **DOI:** 10.1021/ic503095t **Published:** APR 6 2015

Accession Number: WOS:000352518600044

PubMed ID: 25798820

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Spielberg, Eike	D-9890-2015	0000-0002-3333-5814

ISSN: 0020-1669

eISSN: 1520-510X

Record 13 of 37

Title: Readout and dynamics of a qubit built on three quantum dots

Author(s): Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 16 **Article Number:** 165427 **DOI:** 10.1103/PhysRevB.90.165427 **Published:** OCT 21 2014

Accession Number: WOS:000344022800007

ISSN: 2469-9950

eISSN: 2469-9969

Record 14 of 37

Title: Cotunneling signatures of spin-electric coupling in frustrated triangular molecular magnets

Author(s): Nossa, JF (Nossa, J. F.); Canali, CM (Canali, C. M.)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 23 **Article Number:** 235435 **DOI:** 10.1103/PhysRevB.89.235435 **Published:** JUN 30 2014

Accession Number: WOS:000339049700004

ISSN: 1098-0121

eISSN: 1550-235X

Record 15 of 37

Title: Universal non-adiabatic holonomic gates in quantum dots and single-molecule magnets

Author(s): Mousolou, VA (Mousolou, Vahid Azimi); Canali, CM (Canali, Carlo M.); Sjoqvist, E (Sjoqvist, Erik)

Source: NEW JOURNAL OF PHYSICS **Volume:** 16 **Article Number:** 013029 **DOI:** 10.1088/1367-2630/16/1/013029 **Published:** JAN 17 2014

Accession Number: WOS:000330623600006

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Sjoqvist, Erik		0000-0002-4669-1818

ISSN: 1367-2630

Record 16 of 37

Title: Electric control of a {Fe-4} single-molecule magnet in a single-electron transistor

Author(s): Nossa, JF (Nossa, J. F.); Islam, MF (Islam, M. F.); Canali, CM (Canali, C. M.); Pederson, MR (Pederson, M. R.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 22 **Article Number:** 224423 **DOI:** 10.1103/PhysRevB.88.224423 **Published:** DEC 26 2013

Accession Number: WOS:000331753300006

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Islam, Md		0000-0003-1847-0863

ISSN: 1098-0121

eISSN: 1550-235X

Record 17 of 37

Title: Quantum coherence in a triangular Cu-3 complex

Author(s): Lutz, P (Lutz, Philipp); Marx, R (Marx, Raphael); Dengler, D (Dengler, Dominik); Kromer, A (Kromer, Alexander); van Slageren, J (van Slageren, Joris)

Source: MOLECULAR PHYSICS **Volume:** 111 **Issue:** 18-19 **Special Issue:** SI **Pages:** 2897-2902 **DOI:** 10.1080/00268976.2013.826421 **Published:** OCT 1 2013

Accession Number: WOS:000325389800024

ISSN: 0026-8976

eISSN: 1362-3028

Record 18 of 37

Title: Ultrafast magnon transistor at room temperature

Author(s): van Hoogdalem, KA (van Hoogdalem, Kevin A.); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 2 **Article Number:** 024420 **DOI:** 10.1103/PhysRevB.88.024420 **Published:** JUL 19 2013

Accession Number: WOS:000322083500005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 19 of 37

Title: Magnetic entropy change plateau in a geometrically frustrated layered system: FeCrAs-like iron-pnictide structure as a magnetocaloric prototype

Author(s): Florez, JM (Florez, J. M.); Vargas, P (Vargas, P.); Garcia, C (Garcia, C.); Ross, CA (Ross, C. A.)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 25 **Issue:** 22 **Article Number:** 226004 **DOI:** 10.1088/0953-8984/25/22/226004 **Published:** JUN 5 2013

Accession Number: WOS:000319262200018

PubMed ID: 23673475

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Garcia, Carlos	A-1862-2010	0000-0002-4578-5396
vargas, patricio		0000-0001-9235-9747

ISSN: 0953-8984

eISSN: 1361-648X

Record 20 of 37

Title: Many-Body Models for Molecular Nanomagnets

Author(s): Chiesa, A (Chiesa, A.); Carretta, S (Carretta, S.); Santini, P (Santini, P.); Amoretti, G (Amoretti, G.); Pavarini, E (Pavarini, E.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 110 **Issue:** 15 **Article Number:** 157204 **DOI:** 10.1103/PhysRevLett.110.157204 **Published:** APR 9 2013

Accession Number: WOS:000317458400035

PubMed ID: 25167305

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Pavarini, Eva	F-3156-2011	0000-0003-0860-8558
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
Chiesa, Alessandro		0000-0003-2955-3998
Carretta, Stefano		0000-0002-2536-1326

ISSN: 0031-9007

Record 21 of 37

Title: Finite-temperature decoherence of spin states in a {Cu-3} single molecular magnet

Author(s): Hao, X (Hao, Xiang); Wang, XQ (Wang, Xiaoqun); Liu, C (Liu, Chen); Zhu, SQ (Zhu, Shiqun)

Source: JOURNAL OF PHYSICS B-ATOMIC MOLECULAR AND OPTICAL PHYSICS **Volume:** 46 **Issue:** 2 **Article Number:** 025502 **DOI:** 10.1088/0953-4075/46/2/025502 **Published:** JAN 28 2013

Accession Number: WOS:000313569900014

Author Identifiers:

Author	ResearcherID Number	ORCID Number
wang, xiaoqun	G-8865-2011	

ISSN: 0953-4075

Record 22 of 37

Title: Coherent Spin Control by Electrical Manipulation of the Magnetic Anisotropy

Author(s): George, RE (George, Richard E.); Edwards, JP (Edwards, James P.); Ardavan, A (Ardavan, Arzhang)

Source: PHYSICAL REVIEW LETTERS **Volume:** 110 **Issue:** 2 **Article Number:** 027601 **DOI:** 10.1103/PhysRevLett.110.027601 **Published:** JAN 7 2013

Accession Number: WOS:000313162700012

PubMed ID: 23383938

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Edwards, James		0000-0001-6545-1193

ISSN: 0031-9007

Record 23 of 37

Title: Hyperfine-induced decoherence in triangular spin-cluster qubits

Author(s): Troiani, F (Troiani, Filippo); Stepanenko, D (Stepanenko, Dimitrije); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 16 **Article Number:** 161409 **DOI:** 10.1103/PhysRevB.86.161409 **Published:** OCT 17 2012

Accession Number: WOS:000309903500004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 24 of 37

Title: Entanglement in a three spin system controlled by electric and magnetic fields

Author(s): Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 24 **Issue:** 37 **Article Number:** 375303 **DOI:** 10.1088/0953-8984/24/37/375303 **Published:** SEP 19 2012

Accession Number: WOS:000308202700013

PubMed ID: 22913964

ISSN: 0953-8984

eISSN: 1361-648X

Record 25 of 37

Title: First-principles studies of spin-orbit and Dzyaloshinskii-Moriya interactions in the {Cu-3} single-molecule magnet

Author(s): Nossa, JF (Nossa, J. F.); Islam, MF (Islam, M. F.); Canali, CM (Canali, C. M.); Pederson, MR (Pederson, M. R.)

Source: PHYSICAL REVIEW B **Volume:** 85 **Issue:** 8 **Article Number:** 085427 **DOI:** 10.1103/PhysRevB.85.085427 **Published:** FEB 22 2012

Accession Number: WOS:000300566900008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Islam, Md		0000-0003-1847-0863

ISSN: 1098-0121

Record 26 of 37

Title: Density-functional-based prediction of a spin-ordered open-shell singlet in an unpassivated graphene nanofilm

Author(s): Pederson, MR (Pederson, Mark R.)

Source: PHYSICA STATUS SOLIDI B-BASIC SOLID STATE PHYSICS **Volume:** 249 **Issue:** 2 **Pages:** 283-291 **DOI:** 10.1002/pssb.201100796 **Published:** FEB 2012

Accession Number: WOS:000300696000008

ISSN: 0370-1972

Record 27 of 37

Title: New Directions in Electron Paramagnetic Resonance Spectroscopy on Molecular Nanomagnets

Author(s): van Slageren, J (van Slageren, J.)

Edited by: Drescher M; Jeschke G

Source: EPR SPECTROSCOPY: APPLICATIONS IN CHEMISTRY AND BIOLOGY **Book Series:** Topics in Current Chemistry-Series **Volume:** 321 **Pages:** 199-234 **DOI:** 10.1007/128_2011_303 **Published:** 2012

Accession Number: WOS:000321620600008

PubMed ID: 22076082

ISSN: 0340-1022

ISBN: 978-3-642-28347-5; 978-3-642-28346-8

Book DOI: 10.1007/978-3-642-28347-5

Record 28 of 37

Title: Magnetic polyoxometalates: from molecular magnetism to molecular spintronics and quantum computing

Author(s): Clemente-Juan, JM (Clemente-Juan, Juan M.); Coronado, E (Coronado, Eugenio); Gaita-Arino, A (Gaita-Arino, Alejandro)

Source: CHEMICAL SOCIETY REVIEWS **Volume:** 41 **Issue:** 22 **Pages:** 7464-7478 **DOI:** 10.1039/c2cs35205b **Published:** 2012

Accession Number: WOS:000310068300008

PubMed ID: 22948854

Author Identifiers:

Author	ResearcherID Number	ORCID Number
icmol, icmol	I-5784-2015	
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
Coronado, Eugenio	E-8960-2014	
Gaita-Arino, Alejandro	D-2110-2014	
Coronado Miralles, Eugenio		0000-0002-1848-8791

ISSN: 0306-0012

eISSN: 1460-4744

Record 29 of 37

Title: Factorizing magnetic fields triggered by the Dzyaloshinskii-Moriya interaction: Application to magnetic trimers

Author(s): Florez, JM (Florez, J. M.); Vargas, P (Vargas, P.)

Source: JOURNAL OF MAGNETISM AND MAGNETIC MATERIALS **Volume:** 324 **Issue:** 1 **Pages:** 83-89 **DOI:** 10.1016/j.jmmm.2011.07.052 **Published:** JAN 2012

Accession Number: WOS:000294342200017

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Florez, Juan Manuel	E-1452-2011	
vargas, patricio		0000-0001-9235-9747

ISSN: 0304-8853

Record 30 of 37

Title: Quantum magnetoelectric effect in the molecular crystal Dy-3

Author(s): Plokhov, DI (Plokhov, D. I.); Popov, AI (Popov, A. I.); Zvezdin, AK (Zvezdin, A. K.)

Source: PHYSICAL REVIEW B **Volume:** 84 **Issue:** 22 **Article Number:** 224436 **DOI:** 10.1103/PhysRevB.84.224436 **Published:** DEC 28 2011

Accession Number: WOS:000298556800010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Plokhov, Dmitry	I-2141-2018	
Zvezdin, Anatoly	K-8897-2017	
Zvezdin, Anatoly	K-2072-2013	

ISSN: 1098-0121

Record 31 of 37

Title: Electric polarization, toroidal moment, spin canting, and chirality induced by Dzialoshinsky-Moriya interactions in a V-3 cluster analog of multiferroics

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: PHYSICAL REVIEW B **Volume:** 84 **Issue:** 6 **Article Number:** 064425 **DOI:** 10.1103/PhysRevB.84.064425 **Published:** AUG 24 2011

Accession Number: WOS:000294226000008

ISSN: 1098-0121

eISSN: 1550-235X

Record 32 of 37

Title: Electric Polarization Induced by Neel Order without Magnetic Superlattice: Experimental Study of Cu3Mo2O9 and Numerical Study of a Small Spin Cluster

Author(s): Kuroe, H (Kuroe, Haruhiko); Hosaka, T (Hosaka, Tomohiro); Hachiuma, S (Hachiuma, Suguru); Sekine, T (Sekine, Tomoyuki); Hase, M (Hase, Masashi); Oka, K (Oka, Kunihiko); Ito, T (Ito, Toshimitsu); Eisaki, H (Eisaki, Hiroshi); Fujisawa, M (Fujisawa, Masashi); Okubo, S (Okubo, Susumu); Ohta, H (Ohta, Hitoshi)

Source: JOURNAL OF THE PHYSICAL SOCIETY OF JAPAN **Volume:** 80 **Issue:** 8 **Article Number:** 083705 **DOI:** 10.1143/JPSJ.80.083705 **Published:** AUG 2011

Accession Number: WOS:000293836400011

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Oka, Kunihiko	L-6888-2018	0000-0002-0159-124X
Ito, Toshimitsu	K-8543-2012	0000-0003-2094-2807
Eisaki, Hiroshi	F-6317-2018	0000-0002-8299-6416
Hase, Masashi	B-8900-2008	0000-0003-2717-461X

ISSN: 0031-9015

Record 33 of 37

Title: Canonical perturbation theory for inhomogeneous systems of interacting fermions

Author(s): Kostyrko, T (Kostyrko, Tomasz); Bulka, BR (Bulka, Bogdan R.)

Source: PHYSICAL REVIEW B **Volume:** 84 **Issue:** 3 **Article Number:** 035123 **DOI:** 10.1103/PhysRevB.84.035123 **Published:** JUL 26 2011

Accession Number: WOS:000293129200003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Kostyrko, Tomasz		0000-0001-7849-0060

ISSN: 1098-0121

eISSN: 1550-235X

Record 34 of 37

Title: Quantum memory coupled to cavity modes

Author(s): Pedrocchi, FL (Pedrocchi, Fabio L.); Chesi, S (Chesi, Stefano); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 83 **Issue:** 11 **Article Number:** 115415 **DOI:** 10.1103/PhysRevB.83.115415 **Published:** MAR 10 2011

Accession Number: WOS:000288212000008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

Record 35 of 37

Title: Tuning the Energy Level Alignment at the SnPc/Ag(111) Interface Using an STM Tip

Author(s): Toader, M (Toader, Marius); Hietschold, M (Hietschold, Michael)

Source: JOURNAL OF PHYSICAL CHEMISTRY C **Volume:** 115 **Issue:** 7 **Pages:** 3099-3105 **DOI:** 10.1021/jp111478v **Published:** FEB 24 2011

Accession Number: WOS:000287338100025

ISSN: 1932-7447

Record 36 of 37

Title: Magnetic relaxation in basic iron(III) carboxylate [Fe3O(O2CPh)(6)(H2O)(3)]ClO4 center dot py

Author(s): Georgopoulou, AN (Georgopoulou, Anastasia N.); Sanakis, Y (Sanakis, Yiannis); Boudalis, AK (Boudalis, Athanassios K.)

Source: DALTON TRANSACTIONS **Volume:** 40 **Issue:** 24 **Pages:** 6371-6374 **DOI:** 10.1039/c1dt10323g **Published:** 2011

Accession Number: WOS:000291385700006

PubMed ID: 21573306

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Boudalis, Athanassios	F-3799-2014	0000-0002-8797-1170

ISSN: 1477-9226

Record 37 of 37

Title: First-principles study of spin-electric coupling in a {Cu-3} single molecular magnet

Author(s): Islam, MF (Islam, M. Fhokrul); Nossa, JF (Nossa, Javier F.); Canali, CM (Canali, Carlo M.); Pederson, M (Pederson, Mark)

Source: PHYSICAL REVIEW B **Volume:** 82 **Issue:** 15 **Article Number:** 155446 **DOI:** 10.1103/PhysRevB.82.155446 **Published:** OCT 26 2010

Accession Number: WOS:000283488600012

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Islam, Md		0000-0003-1847-0863

ISSN: 1098-0121

Record 1 of 28

Title: Behaviour of DFT-based approaches to the spin-orbit term of zero-field splitting tensors: a case study of metallocomplexes, M-III(acac)(3) (M = V, Cr, Mn, Fe and Mo)

Author(s): Sugisaki, K (Sugisaki, Kenji); Toyota, K (Toyota, Kazuo); Sato, K (Sato, Kazunobu); Shiomi, D (Shiomi, Daisuke); Takui, T (Takui, Takeji)

Source: PHYSICAL CHEMISTRY CHEMICAL PHYSICS **Volume:** 19 **Issue:** 44 **Pages:** 30128-30138 **DOI:** 10.1039/c7cp05533a **Published:** NOV 28 2017

Accession Number: WOS:000415576800045

PubMed ID: 29099522

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Sugisaki, Kenji	H-4801-2012	0000-0002-1950-5725
Sato, Kazunobu	B-2603-2010	0000-0003-1274-7470

ISSN: 1463-9076

eISSN: 1463-9084

Record 2 of 28

Title: Hybrid molecular-inorganic materials: a heterometallic [Ni4Tb] complex grafted on superparamagnetic iron oxide nanoparticles

Author(s): Piquer, LR (Rosado Piquer, L.); Romero, EJ (Romero, E. Jimenez); Lan, Y (Lan, Y.); Wernsdorfer, W (Wernsdorfer, W.); Aromi, G (Aromi, G.); Sanudo, EC (Sanudo, E. C.)

Source: INORGANIC CHEMISTRY FRONTIERS **Volume:** 4 **Issue:** 4 **Pages:** 595-603 **DOI:** 10.1039/c6qi00468g **Published:** APR 1 2017

Accession Number: WOS:000399196000003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
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Wernsdorfer, Wolfgang	M-2280-2016	0000-0003-4602-5257
Aromi, Guillem	I-2483-2015	0000-0002-0997-9484
Rosado Piquer, Lidia		0000-0002-9415-6158

ISSN: 2052-1553

Record 3 of 28

Title: Magnetic Excitations in Polyoxotungstate-Supported Lanthanoid Single-Molecule Magnets: An Inelastic Neutron Scattering and ab Initio Study

Author(s): Vonci, M (Vonci, Michele); Giansiracusa, MJ (Giansiracusa, Marcus J.); Van den Heuvel, W (Van den Heuvel, Willem); Gable, RW (Gable, Robert W.); Moubaraki, B (Moubaraki, Boujemaa); Murray, KS (Murray, Keith S.); Yu, DH (Yu, Dehong); Mole, RA (Mole, Richard A.); Soncini, A (Soncini, Alessandro); Boskovic, C (Boskovic, Colette)

Source: INORGANIC CHEMISTRY **Volume:** 56 **Issue:** 1 **Pages:** 378-394 **DOI:** 10.1021/acs.inorgchem.6b02312 **Published:** JAN 2 2017

Accession Number: WOS:000391248900044

PubMed ID: 27977150

Author Identifiers:

Author	ResearcherID Number	ORCID Number
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Boskovic, Colette		0000-0002-1882-2139
Vonci, Michele		0000-0002-0880-3225
Gable, Robert		0000-0002-4626-0217

ISSN: 0020-1669

eISSN: 1520-510X

Record 4 of 28

Title: Pauli spin blockade in double molecular magnets

Author(s): Plominska, A (Plominska, Anna); Weymann, I (Weymann, Ireneusz)

Source: PHYSICAL REVIEW B **Volume:** 94 **Issue:** 3 **Article Number:** 035422 **DOI:** 10.1103/PhysRevB.94.035422 **Published:** JUL 15 2016

Accession Number: WOS:000379650600002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Weymann, Ireneusz	C-9892-2017	0000-0003-4193-6019

ISSN: 2469-9950

eISSN: 2469-9969

Record 5 of 28

Title: Magnetic Exchange Couplings in Heterodinuclear Complexes Based on Differential Local Spin Rotations

Author(s): Joshi, RP (Joshi, Rajendra P.); Phillips, JJ (Phillips, Jordan J.); Peralta, JE (Peralta, Juan E.)

Source: JOURNAL OF CHEMICAL THEORY AND COMPUTATION **Volume:** 12 **Issue:** 4 **Pages:** 1728-1734 **DOI:** 10.1021/acs.jctc.6b00112 **Published:** APR 2016

Accession Number: WOS:000374196400030

PubMed ID: 26953521

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Peralta, Juan	C-2631-2008	0000-0003-2849-8472

ISSN: 1549-9618

eISSN: 1549-9626

Record 6 of 28

Title: Employing Schiff-base macrocycles to probe the effect of ligand field on the relaxation dynamics of a family of Dy-III SMMs

Author(s): Gavey, EL (Gavey, Emma L.); Pilkington, M (Pilkington, Melanie)

Source: POLYHEDRON **Volume:** 108 **Pages:** 122-130 **DOI:** 10.1016/j.poly.2015.11.008 **Published:** MAR 29 2016

Accession Number: WOS:000375516100019

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Pilkington, Melanie		0000-0002-9274-8512

ISSN: 0277-5387

Record 7 of 28

Title: A Spin-Frustrated Trinuclear Copper Complex Based on Triaminoguanidine with an Energetically Well-Separated Degenerate Ground State

Author(s): Spielberg, ET (Spielberg, Eike T.); Gilb, A (Gilb, Aksana); Plaul, D (Plaul, Daniel); Geibig, D (Geibig, Daniel); Hornig, D (Hornig, David); Schuch, D (Schuch, Dirk); Buchholz, A (Buchholz, Axel); Ardavan, A (Ardavan, Arzhang); Plass, W (Plass, Winfried)

Source: INORGANIC CHEMISTRY **Volume:** 54 **Issue:** 7 **Pages:** 3432-3438 **DOI:** 10.1021/ic503095t **Published:** APR 6 2015

Accession Number: WOS:000352518600044

PubMed ID: 25798820

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Spielberg, Eike	D-9890-2015	0000-0002-3333-5814

ISSN: 0020-1669

eISSN: 1520-510X

Record 8 of 28

Title: Placing a crown on Dy-III - a dual property Ln(III) crown ether complex displaying optical properties and SMM behaviour

Author(s): Gavey, EL (Gavey, Emma L.); Al Hareri, M (Al Hareri, Majeda); Regier, J (Regier, Jeffery); Carlos, LD (Carlos, Luis D.); Ferreira, RAS (Ferreira, Rute A. S.); Razavi, FS (Razavi, Fereidoon S.); Rawson, JM (Rawson, Jeremy M.); Pilkington, M (Pilkington, Melanie)

Source: JOURNAL OF MATERIALS CHEMISTRY C **Volume:** 3 **Issue:** 29 **Pages:** 7738-7747 **DOI:** 10.1039/c5tc01264c **Published:** 2015

Accession Number: WOS:000358228400025

Author Identifiers:

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Rawson, Jeremy		0000-0003-0480-5386
Pilkington, Melanie		0000-0002-9274-8512

ISSN: 2050-7526

eISSN: 2050-7534

Record 9 of 28

Title: Polyoxometalate-Supported Lanthanoid Single-Molecule Magnets

Author(s): Vonci, M (Vonci, Michele); Boskovic, C (Boskovic, Colette)

Source: AUSTRALIAN JOURNAL OF CHEMISTRY **Volume:** 67 **Issue:** 11 **Pages:** 1542-1552 **DOI:** 10.1071/CH14166 **Published:** NOV 2014

Accession Number: WOS:000344924300002

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Vonci, Michele	E-9472-2016	0000-0002-0880-3225
Boskovic, Colette	D-8468-2014	0000-0002-1882-2139

ISSN: 0004-9425

eISSN: 1445-0038

Record 10 of 28

Title: Ising-type magnetic anisotropy and single molecule magnet behaviour in mononuclear trigonal bipyramidal Co(II) complexes

Author(s): Ruamps, R (Ruamps, Renaud); Batchelor, LJ (Batchelor, Luke J.); Guillot, R (Guillot, Regis); Zakhia, G (Zakhia, Georges); Barra, AL (Barra, Anne-Laure); Wernsdorfer, W (Wernsdorfer, W.); Guihery, N (Guihery, Nathalie); Mallah, T (Mallah, Tatal)

Source: CHEMICAL SCIENCE **Volume:** 5 **Issue:** 9 **Pages:** 3418-3424 **DOI:** 10.1039/c4sc00984c **Published:** SEP 2014

Accession Number: WOS:000340695800009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wernsdorfer, Wolfgang	M-2280-2016	0000-0003-4602-5257
Guillot, Regis		0000-0002-9003-0670

ISSN: 2041-6520

eISSN: 2041-6539

Record 11 of 28

Title: New Nanostructured Materials: Synthesis of Dodecanuclear NiII Complexes and Surface Deposition Studies

Author(s): Pons-Balague, A (Pons-Balague, Alba); Piligkos, S (Piligkos, Stergios); Teat, SJ (Teat, Simon J.); Costa, JS (Sanchez Costa, Jose); Shiddiq, M (Shiddiq, Muhandis); Hill, S (Hill, Stephen); Castro, GR (Castro, German R.); Ferrer-Escorihuela, P (Ferrer-Escorihuela, Pilar); Sanudo, EC (Carolina Sanudo, E.)

Source: CHEMISTRY-A EUROPEAN JOURNAL **Volume:** 19 **Issue:** 27 **Pages:** 9064-9071 **DOI:** 10.1002/chem.201204081 **Published:** JUL 2013

Accession Number: WOS:000320782400040

PubMed ID: 23696514

Author Identifiers:

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Piligkos, Stergios	C-7409-2013	0000-0002-4011-6476
Castro, German	H-6679-2015	0000-0003-4251-3245
Sanchez Costa, Jose	N-9085-2014	0000-0001-5426-7956
Shiddiq, Muhandis		0000-0002-8032-0949

ISSN: 0947-6539

eISSN: 1521-3765

Record 12 of 28

Title: Structural, magnetic and electronic characterization of an isostructural series of dinuclear complexes of 3d metal ions bridged by tpbd

Author(s): Reuter, F (Reuter, Frank); Rentschler, E (Rentschler, Eva)

Source: POLYHEDRON **Volume:** 52 **Special Issue:** SI **Pages:** 788-796 **DOI:** 10.1016/j.poly.2012.07.050 **Published:** MAR 22 2013

Accession Number: WOS:000318747100097

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Rentschler, Eva	D-5291-2011	
Reuter, Frank	A-5478-2015	

ISSN: 0277-5387

Record 13 of 28

Title: Synthesis and Characterization of Chromate Cu(II)/Ni(II) Chain Complexes

Author(s): Cai, LY (Cai Liang-Yuan); Qi, Q (Qi Qi); Yang, C (Yang Chun); Jiang, S (Jiang Shan); Jiang, Q (Jiang Qian); Wang, QL (Wang Qing-Lun); Ren, HX (Ren Hong-Xia)

Source: CHEMICAL JOURNAL OF CHINESE UNIVERSITIES-CHINESE **Volume:** 34 **Issue:** 3 **Pages:** 520-526 **DOI:** 10.7503/cjcu20120733 **Published:** MAR 10 2013

Accession Number: WOS:000317085500007

ISSN: 0251-0790

Record 14 of 28

Title: Supramolecular Organization and Magnetic Properties of Mesogen-Hybridized Mixed-Valent Manganese Single Molecule Magnets [(Mn8Mn4O12)-Mn-III-O-IV(L-x,L-y,L-z-CB)(16)(H2O)(4)]

Author(s): Terazzi, E (Terazzi, Emmanuel); Rogez, G (Rogez, Guillaume); Gallani, JL (Gallani, Jean-Louis); Donnio, B (Donnio, Bertrand)

Source: JOURNAL OF THE AMERICAN CHEMICAL SOCIETY **Volume:** 135 **Issue:** 7 **Pages:** 2708-2722 **DOI:** 10.1021/ja311190a **Published:** FEB 20 2013

Accession Number: WOS:000315373000050

PubMed ID: 23339604

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Donnio, Bertrand	I-1305-2016	0000-0001-5907-7705
Rogez, Guillaume		0000-0001-9006-7273

ISSN: 0002-7863

Record 15 of 28

Title: COMPUTATIONAL INVESTIGATION OF A PHOTO-SWITCHABLE SINGLE-MOLECULE MAGNET BASED ON A PORPHYRIN TERBIUM DOUBLE-DECKER COMPLEX

Author(s): Inose, T (Inose, Tomoko); Tanaka, D (Tanaka, Daisuke); Ogawa, T (Ogawa, Takuji)

Source: HETEROCYCLES **Volume:** 86 **Issue:** 2 **Pages:** 1549-1554 **DOI:** 10.3987/COM-12-S(N)86 **Published:** DEC 31 2012

Accession Number: WOS:000314390600057

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Ogawa, Takuji		0000-0002-6237-2286

ISSN: 0385-5414

Record 16 of 28

Title: Cyanido-Bridged Fe(III)-Mn(III) Heterobimetallic Materials Built From Mn(III) Schiff Base Complexes and Di- or Tri-Cyanido Fe(III) Precursors

Author(s): Senapati, T (Senapati, Tapas); Pichon, C (Pichon, Celine); Ababei, R (Ababei, Rodica); Mathoniere, C (Mathoniere, Corine); Clerac, R (Clerac, Rodolphe)

Source: INORGANIC CHEMISTRY **Volume:** 51 **Issue:** 6 **Pages:** 3796-3812 **DOI:** 10.1021/ic2027708 **Published:** MAR 19 2012

Accession Number: WOS:000301624500049

PubMed ID: 22385557

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Pichon, Celine	H-4804-2013	0000-0002-5429-1224
CLERAC, Rodolphe		0000-0001-5429-7418
Mathoniere, Corine		0000-0002-4774-1610

ISSN: 0020-1669

eISSN: 1520-510X

Record 17 of 28

Title: New Directions in Electron Paramagnetic Resonance Spectroscopy on Molecular Nanomagnets

Author(s): van Slageren, J (van Slageren, J.)

Edited by: Drescher M; Jeschke G

Source: EPR SPECTROSCOPY: APPLICATIONS IN CHEMISTRY AND BIOLOGY **Book Series:** Topics in Current Chemistry-Series **Volume:** 321 **Pages:** 199-234 **DOI:** 10.1007/128_2011_303 **Published:** 2012

Accession Number: WOS:000321620600008

PubMed ID: 22076082

ISSN: 0340-1022

ISBN: 978-3-642-28347-5; 978-3-642-28346-8

Book DOI: 10.1007/978-3-642-28347-5

Record 18 of 28

Title: Single molecule magnets and the Lipkin-Meshkov-Glick model

Author(s): Campos, JA (Campos, J. A.); Hirsch, JG (Hirsch, J. G.)

Source: REVISTA MEXICANA DE FISICA **Volume:** 57 **Issue:** 3 **Pages:** 56-61 **Supplement:** S **Published:** JUL 2011

Accession Number: WOS:000298267000010

ISSN: 0035-001X

Record 19 of 28

Title: Beyond the spin model: exchange coupling in molecular magnets with unquenched orbital angular momenta

Author(s): Palii, A (Palii, Andrei); Tsukerblat, B (Tsukerblat, Boris); Klokishner, S (Klokishner, Sophia); Dunbar, KR (Dunbar, Kim R.); Clemente-Juan, JM (Clemente-Juan, Juan M.); Coronado, E (Coronado, Eugenio)

Source: CHEMICAL SOCIETY REVIEWS **Volume:** 40 **Issue:** 6 **Pages:** 3130-3156 **DOI:** 10.1039/c0cs00175a **Published:** 2011

Accession Number: WOS:000290866700007

PubMed ID: 21431145

Author Identifiers:

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Dunbar, Kim	B-6488-2015	0000-0001-5728-7805

Coronado, Eugenio	E-8960-2014	
icmol, icmol	I-5784-2015	
Coronado Miralles, Eugenio		0000-0002-1848-8791

ISSN: 0306-0012

Record 20 of 28

Title: Direct and two-phonon Orbach-Aminov type spin-lattice relaxation in molecular magnet V-15

Author(s): Tarantul, A (Tarantul, Alex); Tsukerblat, B (Tsukerblat, Boris)

Book Group Author(s): IOP

Source: INTERNATIONAL CONFERENCE ON RESONANCES IN CONDENSED MATTER: ALTSHULER100 **Book Series:** Journal of Physics Conference Series **Volume:** 324 **Article Number:** 012007 **DOI:** 10.1088/1742-6596/324/1/012007 **Published:** 2011

Accession Number: WOS:000299528100009

Conference Title: International Conference on Resonances in Condensed Matter

Conference Date: JUN 21-25, 2011

Conference Location: Fed Univ, Kazan, RUSSIA

Conference Host: Fed Univ

ISSN: 1742-6588

Record 21 of 28

Title: Magnetic relaxation in V-15 cluster: Direct spin-phonon transitions

Author(s): Tarantul, A (Tarantul, Alex); Tsukerblat, B (Tsukerblat, Boris)

Source: INORGANICA CHIMICA ACTA **Volume:** 363 **Issue:** 15 **Pages:** 4361-4367 **DOI:** 10.1016/j.ica.2010.07.080 **Published:** DEC 10 2010

Accession Number: WOS:000284626700033

ISSN: 0020-1693

Record 22 of 28

Title: Magneto-optical interactions in single-molecule magnets: Low-temperature photon-induced demagnetization

Author(s): Donnio, B (Donnio, B.); Riviere, E (Riviere, E.); Terazzi, E (Terazzi, E.); Voirin, E (Voirin, E.); Aronica, C (Aronica, C.); Chastanet, G (Chastanet, G.); Luneau, D (Luneau, D.); Rogez, G (Rogez, G.); Scheurer, F (Scheurer, F.); Joly, L (Joly, L.); Kappler, JP (Kappler, J. -P.); Gallani, JL (Gallani, J. -L.)

Source: SOLID STATE SCIENCES **Volume:** 12 **Issue:** 8 **Pages:** 1307-1313 **DOI:** 10.1016/j.solidstatesciences.2010.06.003 **Published:** AUG 2010

Accession Number: WOS:000281362100002

Author Identifiers:

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LUNEAU, Dominique	B-5359-2012	0000-0002-1831-7693
Rogez, Guillaume		0000-0001-9006-7273
CHASTANET, guillaume		0000-0001-6829-4066

ISSN: 1293-2558

Record 23 of 28

Title: Microspectroscopic Analysis of the X-Ray-induced Photoreduction in Fe- and Mn-containing SMMs

Author(s): Schmidt, N (Schmidt, Norman); Scheurer, A (Scheurer, Andreas); Sperner, S (Sperner, Stefan); Fink, RH (Fink, Rainer H.)

Source: ZEITSCHRIFT FUR NATURFORSCHUNG SECTION B-A JOURNAL OF CHEMICAL SCIENCES **Volume:** 65 **Issue:** 3 **Pages:** 390-398 **Published:** MAR 2010

Accession Number: WOS:000278403700024

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Fink, Rainer H.	F-8365-2010	0000-0002-6896-4266
Fink, Rainer	C-5333-2008	0000-0002-6896-4266
Scheurer, Andreas	A-2748-2012	0000-0002-2858-9406
Schmidt, Norman		0000-0001-7374-5204

ISSN: 0932-0776

Record 24 of 28

Title: Magnetic exchange between metal ions with unquenched orbital angular momenta: basic concepts and relevance to molecular magnetism

Author(s): Palii, A (Palii, Andrei); Tsukerblat, B (Tsukerblat, Boris); Clemente-Juan, JM (Clemente-Juan, Juan Modesto); Coronado, E (Coronado, Eugenio)

Source: INTERNATIONAL REVIEWS IN PHYSICAL CHEMISTRY **Volume:** 29 **Issue:** 1 **Pages:** 135-230 **Article Number:** PII 918980501 **DOI:** 10.1080/01442350903435256 **Published:** 2010

Accession Number: WOS:000277457800003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Coronado, Eugenio	E-8960-2014	
Clemente-Juan, Juan	D-4499-2013	0000-0002-3198-073X
icmol, icmol	I-5784-2015	

Coronado Miralles, Eugenio		0000-0002-1848-8791

ISSN: 0144-235X

eISSN: 1366-591X

Record 25 of 28

Title: Structural variety and magnetic properties of polynuclear assemblies based on 2-aminoglucose and tritopic triaminoguanidine ligands

Author(s): Plass, W (Plass, Winfried)

Source: COORDINATION CHEMISTRY REVIEWS **Volume:** 253 **Issue:** 19-20 **Pages:** 2286-2295 **DOI:** 10.1016/j.ccr.2008.12.002 **Published:** OCT 2009

Accession Number: WOS:000269991100004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Plass, Winfried	D-2715-2009	

ISSN: 0010-8545

Record 26 of 28

Title: Jahn-Teller Effect in Molecular Magnetism: An Overview

Author(s): Tsukerblat, B (Tsukerblat, Boris); Klokishner, S (Klokishner, Sophia); Palii, A (Palii, Andrew)

Edited by: Koppel H; Yarkony DR; Barentzen H

Source: JAHN-TELLER EFFECT: FUNDAMENTALS AND IMPLICATIONS FOR PHYSICS AND CHEMISTRY **Book Series:** Springer Series in Chemical Physics **Volume:** 97 **Pages:** 555-+ **Published:** 2009

Accession Number: WOS:000292113400018

Conference Title: 19th International Jahn-Teller Symposium

Conference Date: AUG 25-29, 2008

Conference Location: Univ Campus, Heidelberg, GERMANY

Conference Host: Univ Campus

ISSN: 0172-6218

ISBN: 978-3-642-03431-2

Record 27 of 28

Title: Bimetallic cyanido-bridged magnetic materials derived from manganese(III) Schiff-base complexes and pentacyanidonitrosylferrate(II) precursor

Author(s): Ababei, R (Ababei, Rodica); Li, YG (Li, Yang-Guang); Roubeau, O (Roubeau, Olivier); Kalisz, M (Kalisz, Marguerite); Brefuel, N (Brefuel, Nicolas); Coulon, C (Coulon, Claude); Harte, E (Harte, Etienne); Liu, XT (Liu, Xueting); Mathoniere, C (Mathoniere, Corine); Clerac, R (Clerac, Rodolphe)

Source: NEW JOURNAL OF CHEMISTRY **Volume:** 33 **Issue:** 6 **Pages:** 1237-1248 **DOI:** 10.1039/b903399h **Published:** 2009

Accession Number: WOS:000266655400008

Conference Title: 3rd International Symposium on Molecular Materials

Conference Date: JUL, 2008

Conference Location: Toulouse, FRANCE

Author Identifiers:

Author	ResearcherID Number	ORCID Number
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Mathoniere, Corine		0000-0002-4774-1610
CLERAC, Rodolphe		0000-0001-5429-7418

ISSN: 1144-0546

eISSN: 1369-9261

Record 28 of 28

Title: Molecular magnetism: A philosophical perspective from a biased point of view

Author(s): Dei, A (Dei, Andrea)

Source: INORGANICA CHIMICA ACTA **Volume:** 361 **Issue:** 12-13 **Pages:** 3344-3355 **DOI:** 10.1016/j.ica.2008.02.032 **Published:** SEP 1 2008

Accession Number: WOS:000258394200003

ISSN: 0020-1693

eISSN: 1873-3255

Record 1 of 24

Title: Two-qubit logical operations in three quantum dots system

Author(s): Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 30 **Issue:** 22 **Article Number:** 225601 **DOI:** 10.1088/1361-648X/aabe50 **Published:** JUN 6 2018

Accession Number: WOS:000431454300001

PubMed ID: 29658887

ISSN: 0953-8984

eISSN: 1361-648X

Record 2 of 24

Title: Three-electron spin qubits

Author(s): Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)

Source: JOURNAL OF PHYSICS-CONDENSED MATTER **Volume:** 29 **Issue:** 39 **Article Number:** 393001 **DOI:** 10.1088/1361-648X/aa761f **Published:** OCT 4 2017

Accession Number: WOS:000408760400001

PubMed ID: 28562367

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Russ, Maximilian		0000-0001-9775-0323

ISSN: 0953-8984

eISSN: 1361-648X

Record 3 of 24

Title: Robust quantum state transfer inspired by Dzyaloshinskii-Moriya interactions

Author(s): Shi, X (Shi, X.); Yuan, H (Yuan, H.); Mao, X (Mao, X.); Ma, Y (Ma, Y.); Zhao, HQ (Zhao, H. Q.)

Source: PHYSICAL REVIEW A **Volume:** 95 **Issue:** 5 **Article Number:** 052332 **DOI:** 10.1103/PhysRevA.95.052332 **Published:** MAY 16 2017

Accession Number: WOS:000401444200004

ISSN: 2469-9926

eISSN: 2469-9934

Record 4 of 24

Title: Robust universal gates for quantum-dot spin qubits using tunable adiabatic passages

Author(s): Gong, B (Gong, Bo); Wang, L (Wang, Li); Tu, T (Tu, Tao); Li, CF (Li, Chuan-Feng); Guo, GC (Guo, Guang-Can)

Source: PHYSICAL REVIEW A **Volume:** 94 **Issue:** 3 **Article Number:** 032311 **DOI:** 10.1103/PhysRevA.94.032311 **Published:** SEP 12 2016

Accession Number: WOS:000383136800001

ISSN: 2469-9926

eISSN: 2469-9934

Record 5 of 24

Title: Reduced Sensitivity to Charge Noise in Semiconductor Spin Qubits via Symmetric Operation

Author(s): Reed, MD (Reed, M. D.); Maune, BM (Maune, B. M.); Andrews, RW (Andrews, R. W.); Borselli, MG (Borselli, M. G.); Eng, K (Eng, K.); Jura, MP (Jura, M. P.); Kiselev, AA (Kiselev, A. A.); Ladd, TD (Ladd, T. D.); Merkel, ST (Merkel, S. T.); Milosavljevic, I (Milosavljevic, I.); Pritchett, EJ (Pritchett, E. J.); Rakher, MT (Rakher, M. T.); Ross, RS (Ross, R. S.); Schmitz, AE (Schmitz, A. E.); Smith, A (Smith, A.); Wright, JA (Wright, J. A.); Gyure, MF (Gyure, M. F.); Hunter, AT (Hunter, A. T.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 116 **Issue:** 11 **Article Number:** 110402 **DOI:** 10.1103/PhysRevLett.116.110402 **Published:** MAR 16 2016

Accession Number: WOS:000372432300001

PubMed ID: 27035289

ISSN: 0031-9007

eISSN: 1079-7114

Record 6 of 24

Title: Capacitively coupled singlet-triplet qubits in the double charge resonant regime

Author(s): Srinivasa, V (Srinivasa, V.); Taylor, JM (Taylor, J. M.)

Source: PHYSICAL REVIEW B **Volume:** 92 **Issue:** 23 **Article Number:** 235301 **DOI:** 10.1103/PhysRevB.92.235301 **Published:** DEC 1 2015

Accession Number: WOS:000365774000005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Taylor, Jacob	B-7826-2011	0000-0003-0493-5594

ISSN: 2469-9950

eISSN: 2469-9969

Record 7 of 24

Title: Asymmetric resonant exchange qubit under the influence of electrical noise

Author(s): Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 23 **Article Number:** 235411 **DOI:** 10.1103/PhysRevB.91.235411 **Published:** JUN 9 2015

Accession Number: WOS:000355825700003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Burkard, Guido	A-6949-2008	0000-0001-9053-2200
Russ, Maximilian		0000-0001-9775-0323

ISSN: 1098-0121

eISSN: 1550-235X

Record 8 of 24

Title: Probe-assisted spin manipulation in one-dimensional quantum dots

Author(s): Gindikin, Y (Gindikin, Yasha); Sablikov, VA (Sablikov, Vladimir A.)

Source: PHYSICA STATUS SOLIDI-RAPID RESEARCH LETTERS **Volume:** 9 **Issue:** 6 **Pages:** 366-370 **DOI:** 10.1002/pssr.201510074 **Published:** JUN 2015

Accession Number: WOS:000356869000007

ISSN: 1862-6254

eISSN: 1862-6270

Record 9 of 24

Title: Coupled-qubit Tavis-Cummings scheme for prolonging quantum coherence

Author(s): De, A (De, Amrit)

Source: PHYSICAL REVIEW A **Volume:** 91 **Issue:** 1 **Article Number:** 012317 **DOI:** 10.1103/PhysRevA.91.012317 **Published:** JAN 13 2015

Accession Number: WOS:000349338700002

ISSN: 1050-2947

eISSN: 1094-1622

Record 10 of 24

Title: Directly accessible entangling gates for capacitively coupled singlet-triplet qubits

Author(s): Calderon-Vargas, FA (Calderon-Vargas, F. A.); Kestner, JP (Kestner, J. P.)

Source: PHYSICAL REVIEW B **Volume:** 91 **Issue:** 3 **Article Number:** 035301 **DOI:** 10.1103/PhysRevB.91.035301 **Published:** JAN 6 2015

Accession Number: WOS:000348703700006

ISSN: 2469-9950

eISSN: 2469-9969

Record 11 of 24

Title: Improving the gate fidelity of capacitively coupled spin qubits

Author(s): Wang, X (Wang, Xin); Barnes, E (Barnes, Edwin); Das Sarma, S (Das Sarma, S.)

Source: NPJ QUANTUM INFORMATION **Volume:** 1 **Article Number:** 15003 **DOI:** 10.1038/npjqi.2015.3 **Published:** 2015

Accession Number: WOS:000209883800008

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Wang, Xin	F-5509-2011	0000-0003-2971-5088
Das Sarma, Sankar		0000-0002-0439-986X

ISSN: 2056-6387

Record 12 of 24

Title: Single-spin manipulation in a double quantum dot in the field of a micromagnet

Author(s): Chesi, S (Chesi, Stefano); Wang, YD (Wang, Ying-Dan); Yoneda, J (Yoneda, Jun); Otsuka, T (Otsuka, Tomohiro); Tarucha, S (Tarucha, Seigo); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 23 **Article Number:** 235311 **DOI:** 10.1103/PhysRevB.90.235311 **Published:** DEC 15 2014

Accession Number: WOS:000346377400002

Author Identifiers:

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TARUCHA, SEIGO	I-7030-2012	
Yoneda, Jun	C-6031-2017	0000-0003-0743-3696
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

eISSN: 1550-235X

Record 13 of 24

Title: Hybrid Spin and Valley Quantum Computing with Singlet-Triplet Qubits

Author(s): Rohling, N (Rohling, Niklas); Russ, M (Russ, Maximilian); Burkard, G (Burkard, Guido)

Source: PHYSICAL REVIEW LETTERS **Volume:** 113 **Issue:** 17 **Article Number:** 176801 **DOI:** 10.1103/PhysRevLett.113.176801 **Published:** OCT 21 2014

Accession Number: WOS:000344052700008

PubMed ID: 25379928

Author Identifiers:

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Russ, Maximilian		0000-0001-9775-0323
Rohling, Niklas		0000-0002-2067-5852

ISSN: 0031-9007

eISSN: 1079-7114

Record 14 of 24

Title: Counter-diabatic driving for fast spin control in a two-electron double quantum dot

Author(s): Ban, Y (Ban, Yue); Chen, X (Chen, Xi)

Source: SCIENTIFIC REPORTS **Volume:** 4 **Article Number:** 6258 **DOI:** 10.1038/srep06258 **Published:** SEP 1 2014

Accession Number: WOS:000341441500004

PubMed ID: 25174453

ISSN: 2045-2322

Record 15 of 24

Title: Exchange-based two-qubit gate for singlet-triplet qubits

Author(s): Wardrop, MP (Wardrop, Matthew P.); Doherty, AC (Doherty, Andrew C.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 4 **Article Number:** 045418 **DOI:** 10.1103/PhysRevB.90.045418 **Published:** JUL 21 2014

Accession Number: WOS:000339444100009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Doherty, Andrew	D-1816-2010	0000-0002-8069-7754

ISSN: 1098-0121

eISSN: 1550-235X

Record 16 of 24

Title: Two-qubit couplings of singlet-triplet qubits mediated by one quantum state

Author(s): Mehl, S (Mehl, Sebastian); Bluhm, H (Bluhm, Hendrik); DiVincenzo, DP (DiVincenzo, David P.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 4 **Article Number:** 045404 **DOI:** 10.1103/PhysRevB.90.045404 **Published:** JUL 9 2014

Accession Number: WOS:000338738600014

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Bluhm, Hendrik	D-3422-2014	0000-0002-5224-7254
DiVincenzo, David	H-5952-2013	0000-0003-4332-645X

ISSN: 2469-9950

eISSN: 2469-9969

Record 17 of 24

Title: Phonon-mediated decay of singlet-triplet qubits in double quantum dots

Author(s): Kornich, V (Kornich, Viktoriia); Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 8 **Article Number:** 085410 **DOI:** 10.1103/PhysRevB.89.085410 **Published:** FEB 12 2014

Accession Number: WOS:000332384300003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 2469-9950

eISSN: 2469-9969

Record 18 of 24

Title: Robust quantum gates for singlet-triplet spin qubits using composite pulses

Author(s): Wang, X (Wang, Xin); Bishop, LS (Bishop, Lev S.); Barnes, E (Barnes, Edwin); Kestner, JP (Kestner, J. P.); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW A **Volume:** 89 **Issue:** 2 **Article Number:** 022310 **DOI:** 10.1103/PhysRevA.89.022310 **Published:** FEB 11 2014

Accession Number: WOS:000332222800003

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Das Sarma, Sankar	B-2400-2009	0000-0002-0439-986X
Barnes, Edwin	A-1583-2013	
Wang, Xin	F-5509-2011	0000-0003-2971-5088
Bishop, Lev	C-5476-2009	0000-0003-1318-1149

ISSN: 1050-2947

eISSN: 1094-1622

Record 19 of 24

Title: Driven Nonlinear Dynamics of Two Coupled Exchange-Only Qubits

Author(s): Pal, A (Pal, Arijeet); Rashba, EI (Rashba, Emmanuel I.); Halperin, BI (Halperin, Bertrand I.)

Source: PHYSICAL REVIEW X **Volume:** 4 **Issue:** 1 **Article Number:** 011012 **DOI:** 10.1103/PhysRevX.4.011012 **Published:** JAN 30 2014

Accession Number: WOS:000332155300003

ISSN: 2160-3308

Record 20 of 24

Title: Coupling Spin Qubits via Superconductors

Author(s): Leijnse, M (Leijnse, Martin); Flensberg, K (Flensberg, Karsten)

Source: PHYSICAL REVIEW LETTERS **Volume:** 111 **Issue:** 6 **Article Number:** 060501 **DOI:** 10.1103/PhysRevLett.111.060501 **Published:** AUG 6 2013

Accession Number: WOS:000322786500001

PubMed ID: 23971543

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Leijnse, Martin	D-3116-2015	0000-0003-3639-8594
Flensberg, Karsten	N-4718-2014	0000-0002-8311-0103

ISSN: 0031-9007

Record 21 of 24

Title: Two-Qubit Gates for Resonant Exchange Qubits

Author(s): Doherty, AC (Doherty, Andrew C.); Wardrop, MP (Wardrop, Matthew P.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 111 **Issue:** 5 **Article Number:** 050503 **DOI:** 10.1103/PhysRevLett.111.050503 **Published:** JUL 31 2013

Accession Number: WOS:000322728500004

PubMed ID: 23952377

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Doherty, Andrew	D-1816-2010	0000-0002-8069-7754

ISSN: 0031-9007

Record 22 of 24

Title: Noise-Resistant Control for a Spin Qubit Array

Author(s): Kestner, JP (Kestner, J. P.); Wang, X (Wang, Xin); Bishop, LS (Bishop, Lev S.); Barnes, E (Barnes, Edwin); Das Sarma, S (Das Sarma, S.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 110 **Issue:** 14 **Article Number:** 140502 **DOI:** 10.1103/PhysRevLett.110.140502 **Published:** APR 5 2013

Accession Number: WOS:000317190800002

PubMed ID: 25166970

Author Identifiers:

Author	ResearcherID Number	ORCID Number
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Wang, Xin	F-5509-2011	0000-0003-2971-5088
Barnes, Edwin	A-1583-2013	

ISSN: 0031-9007

eISSN: 1079-7114

Record 23 of 24

Title: Prospects for Spin-Based Quantum Computing in Quantum Dots

Author(s): Kloeffel, C (Kloeffel, Christoph); Loss, D (Loss, Daniel)

Edited by: Langer JS

Source: ANNUAL REVIEW OF CONDENSED MATTER PHYSICS, VOL 4 **Book Series:** Annual Review of Condensed Matter Physics **Volume:** 4 **Pages:** 51-81 **DOI:** 10.1146/annurev-conmatphys-030212-184248 **Published:** 2013

Accession Number: WOS:000321694300004

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1947-5454

ISBN: 978-0-8243-5004-8

Record 24 of 24

Title: Controllable exchange coupling between two singlet-triplet qubits

Author(s): Li, R (Li, Rui); Hu, XD (Hu, Xuedong); You, JQ (You, J. Q.)

Source: PHYSICAL REVIEW B **Volume:** 86 **Issue:** 20 **Article Number:** 205306 **DOI:** 10.1103/PhysRevB.86.205306 **Published:** NOV 6 2012

Accession Number: WOS:000310841900005

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Li, Rui	I-2369-2012	0000-0003-1900-5998

ISSN: 1098-0121

Record 1 of 19

Title: Interactions between H-bonded [CuII3((3)-OH)] triangles; a combined magnetic susceptibility and EPR study

Author(s): Mathivathanan, L (Mathivathanan, Logesh); Boudalis, AK (Boudalis, Athanassios K.); Turek, P (Turek, Philippe); Pissas, M (Pissas, Michael); Sanakis, Y (Sanakis, Yiannis); Raptis, RG (Raptis, Raphael G.)

Source: PHYSICAL CHEMISTRY CHEMICAL PHYSICS **Volume:** 20 **Issue:** 25 **Pages:** 17234-17244 **DOI:** 10.1039/c8cp02643b **Published:** JUL 7 2018

Accession Number: WOS:000436571800038

PubMed ID: 29901059

Author Identifiers:

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Mathivathanan, Logesh		0000-0002-3666-885X

ISSN: 1463-9076

eISSN: 1463-9084

Record 2 of 19

Title: Dynamic versus Static Character of the Magnetic Jahn-Teller Effect: Magnetostructural Studies of [Fe3O(O2CPh)(6)(py)(3)]ClO4 center dot py

Author(s): Georgopoulou, AN (Georgopoulou, Anastasia N.); Margiolaki, I (Margiolaki, Irene); Psycharis, V (Psycharis, Vassilis); Boudalis, AK (Boudalis, Athanassios K.)

Source: INORGANIC CHEMISTRY **Volume:** 56 **Issue:** 2 **Pages:** 762-772 **DOI:** 10.1021/acs.inorgchem.6b01912 **Published:** JAN 16 2017

Accession Number: WOS:000392262400013

PubMed ID: 28045513

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Boudalis, Athanassios		0000-0002-8797-1170

ISSN: 0020-1669

eISSN: 1520-510X

Record 3 of 19

Title: Spin Chirality of Cu-3 and V-3 Nanomagnets. 1. Rotation Behavior of Vector Chirality, Scalar Chirality, and Magnetization in the Rotating Magnetic Field, Magnetochiral Correlations

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: INORGANIC CHEMISTRY **Volume:** 55 **Issue:** 9 **Pages:** 4078-4090 **DOI:** 10.1021/acs.inorgchem.5b02202 **Published:** MAY 2 2016

Accession Number: WOS:000375519700004

PubMed ID: 27070665

ISSN: 0020-1669

eISSN: 1520-510X

Record 4 of 19

Title: Spin Chirality of Cu-3 and V-3 Nanomagnets. 2. Frustration, Temperature, and Distortion Dependence of Spin Chiralities and Magnetization in the Rotating and Tilted Magnetic Fields

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: INORGANIC CHEMISTRY **Volume:** 55 **Issue:** 9 **Pages:** 4091-4109 **DOI:** 10.1021/acs.inorgchem.5b02204 **Published:** MAY 2 2016

Accession Number: WOS:000375519700005

PubMed ID: 27070817

ISSN: 0020-1669

eISSN: 1520-510X

Record 5 of 19

Title: Josephson effect in a triple-quantum-dot ring with one dot coupled to superconductors: Numerical renormalization group calculations

Author(s): Yi, GY (Yi, Guang-Yu); Wang, XQ (Wang, Xiao-Qi); Gong, WJ (Gong, Wei-Jiang); Wu, HN (Wu, Hai-Na); Chen, XH (Chen, Xiao-Hui)

Source: PHYSICS LETTERS A **Volume:** 380 **Issue:** 14-15 **Pages:** 1385-1391 **DOI:** 10.1016/j.physleta.2016.02.013 **Published:** MAR 24 2016

Accession Number: WOS:000371947500008

ISSN: 0375-9601

eISSN: 1873-2429

Record 6 of 19

Title: Coherence and organisation in lanthanoid complexes: from single ion magnets to spin qubits

Author(s): Gaita-Arino, A (Gaita-Arino, Alejandro); Prima-Garcia, H (Prima-Garcia, Helena); Cardona-Serra, S (Cardona-Serra, Salvador); Escalera-Moreno, L (Escalera-Moreno, Luis); Rosaleny, LE (Rosaleny, Lorena E.); Baldovi, JJ (Baldovi, Jose J.)

Source: INORGANIC CHEMISTRY FRONTIERS **Volume:** 3 **Issue:** 5 **Pages:** 568-577 **DOI:** 10.1039/c5qi00296f **Published:** 2016

Accession Number: WOS:000376139200001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Baldovi, Jose J.		0000-0002-2277-3974

ISSN: 2052-1553

Record 7 of 19

Title: Probing the effective nuclear-spin magnetic field in a single quantum dot via full counting statistics

Author(s): Xue, HB (Xue, Hai-Bin); Nie, YH (Nie, Yi-Hang); Chen, JZ (Chen, Jingzhe); Ren, W (Ren, Wei)

Source: ANNALS OF PHYSICS **Volume:** 354 **Pages:** 375-384 **DOI:** 10.1016/j.aop.2015.01.001 **Published:** MAR 2015

Accession Number: WOS:000353079500024

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Xue, Hai-Bin	B-6008-2012	0000-0002-1223-3616

ISSN: 0003-4916

eISSN: 1096-035X

Record 8 of 19

Title: Quantum Computation with Molecular Nanomagnets: Achievements, Challenges, and New Trends

Author(s): Ghirri, A (Ghirri, Alberto); Troiani, F (Troiani, Filippo); Affronte, M (Affronte, Marco)

Edited by: Gao S

Source: MOLECULAR NANOMAGNETS AND RELATED PHENOMENA **Book Series:** Structure and Bonding **Volume:** 164 **Pages:** 383-430 **DOI:** 10.1007/430_2014_145 **Published:** 2015

Accession Number: WOS:000370245000009

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
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ISSN: 0081-5993

ISBN: 978-3-662-45723-8; 978-3-662-45722-1

Book DOI: 10.1007/978-3-662-45723-8

Record 9 of 19

Title: Effects of the Dzyaloshinskii-Moriya interaction in Cr-3 triangular spin clusters detected by specific heat and multi-frequency electron spin resonance

Author(s): Ghirri, A (Ghirri, Alberto); van Tol, J (van Tol, Johan); Vitorica-Yrezabal, I (Vitorica-Yrezabal, Inigo); Timco, GA (Timco, Grigore A.); Winpenny, REP (Winpenny, Richard E. P.)

Source: DALTON TRANSACTIONS **Volume:** 44 **Issue:** 31 **Pages:** 14027-14033 **DOI:** 10.1039/c5dt01938a **Published:** 2015

Accession Number: WOS:000359089100028

PubMed ID: 26165805

Author Identifiers:

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van Tol, Johan	G-4190-2011	0000-0001-6972-2149
GHIRRI, ALBERTO		0000-0001-7316-3765

ISSN: 1477-9226

eISSN: 1477-9234

Record 10 of 19

Title: Readout and dynamics of a qubit built on three quantum dots

Author(s): Luczak, J (Luczak, Jakub); Bulka, BR (Bulka, Bogdan R.)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 16 **Article Number:** 165427 **DOI:** 10.1103/PhysRevB.90.165427 **Published:** OCT 21 2014

Accession Number: WOS:000344022800007

ISSN: 2469-9950

eISSN: 2469-9969

Record 11 of 19

Title: Decoherence of an exchange qubit by hyperfine interaction

Author(s): Hung, JT (Hung, Jo-Tzu); Fei, JJ (Fei, Jianjia); Friesen, M (Friesen, Mark); Hu, XD (Hu, Xuedong)

Source: PHYSICAL REVIEW B **Volume:** 90 **Issue:** 4 **Article Number:** 045308 **DOI:** 10.1103/PhysRevB.90.045308 **Published:** JUL 18 2014

Accession Number: WOS:000339445300005

ISSN: 1098-0121

eISSN: 1550-235X

Record 12 of 19

Title: Field-dependent spin chirality and frustration in V-3 and Cu-3 nanomagnets in transverse magnetic field. 1. Correlations between variable planar spin configurations, vector and scalar chiralities and magnetization

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: CHEMICAL PHYSICS **Volume:** 435 **Pages:** 62-94 **DOI:** 10.1016/j.chemphys.2013.11.012 **Published:** MAY 19 2014

Accession Number: WOS:000334758200009

ISSN: 0301-0104

eISSN: 1873-4421

Record 13 of 19

Title: Field- dependent spin chirality and frustration in V-3 and Cu-3 nanomagnets in transverse magnetic field. 2. Spin configurations, chirality and intermediate spin magnetization in distorted trimers

Author(s): Belinsky, MI (Belinsky, Moisey I.)

Source: CHEMICAL PHYSICS **Volume:** 435 **Pages:** 95-125 **DOI:** 10.1016/j.chemphys.2013.10.009 **Published:** MAY 19 2014

Accession Number: WOS:000334758200010

ISSN: 0301-0104

eISSN: 1873-4421

Record 14 of 19

Title: Robustness of quantum gates with hybrid spin-photon qubits in superconducting resonators

Author(s): Chiesa, A (Chiesa, A.); Gerace, D (Gerace, D.); Troiani, F (Troiani, F.); Amoretti, G (Amoretti, G.); Santini, P (Santini, P.); Carretta, S (Carretta, S.)

Source: PHYSICAL REVIEW A **Volume:** 89 **Issue:** 5 **Article Number:** 052308 **DOI:** 10.1103/PhysRevA.89.052308 **Published:** MAY 9 2014

Accession Number: WOS:000335998300003

Author Identifiers:

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Gerace, Dario	L-4405-2013	
Troiani, Filippo	B-4787-2011	
GERACE, Dario		0000-0002-7442-125X
Carretta, Stefano		0000-0002-2536-1326

ISSN: 1050-2947

eISSN: 1094-1622

Record 15 of 19

Title: Magnetic properties and hyperfine interactions in Cr-8, Cr7Cd, and Cr7Ni molecular rings from F-19-NMR

Author(s): Bordonali, L (Bordonali, L.); Garlatti, E (Garlatti, E.); Casadei, CM (Casadei, C. M.); Furukawa, Y (Furukawa, Y.); Lascialfari, A (Lascialfari, A.); Carretta, S (Carretta, S.); Troiani, F (Troiani, F.); Timco, G (Timco, G.); Winpenny, REP (Winpenny, R. E. P.); Borsa, F (Borsa, F.)

Source: JOURNAL OF CHEMICAL PHYSICS **Volume:** 140 **Issue:** 14 **Article Number:** 144306 **DOI:** 10.1063/1.4870469 **Published:** APR 14 2014

Accession Number: WOS:000334836600018

PubMed ID: 24735298

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	
Carretta, Stefano		0000-0002-2536-1326
Garlatti, Elena		0000-0002-0370-0534

ISSN: 0021-9606

eISSN: 1089-7690

Record 16 of 19

Title: Anisotropic g factor in InAs self-assembled quantum dots

Author(s): Zielke, R (Zielke, Robert); Maier, F (Maier, Franziska); Loss, D (Loss, Daniel)

Source: PHYSICAL REVIEW B **Volume:** 89 **Issue:** 11 **Article Number:** 115438 **DOI:** 10.1103/PhysRevB.89.115438 **Published:** MAR 31 2014

Accession Number: WOS:000333558200010

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Loss, Daniel	A-3721-2008	0000-0001-5176-3073

ISSN: 1098-0121

eISSN: 1550-235X

Record 17 of 19

Title: Size of linear superpositions in molecular nanomagnets

Author(s): Troiani, F (Troiani, F.); Zanardi, P (Zanardi, P.)

Source: PHYSICAL REVIEW B **Volume:** 88 **Issue:** 9 **Article Number:** 094413 **DOI:** 10.1103/PhysRevB.88.094413 **Published:** SEP 10 2013

Accession Number: WOS:000324229100001

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Troiani, Filippo	B-4787-2011	

ISSN: 1098-0121

Record 18 of 19

Title: Quantum Information Processing with Hybrid Spin-Photon Qubit Encoding

Author(s): Carretta, S (Carretta, S.); Chiesa, A (Chiesa, A.); Troiani, F (Troiani, F.); Gerace, D (Gerace, D.); Amoretti, G (Amoretti, G.); Santini, P (Santini, P.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 111 **Issue:** 11 **Article Number:** 110501 **DOI:** 10.1103/PhysRevLett.111.110501 **Published:** SEP 10 2013

Accession Number: WOS:000324233400001

PubMed ID: 24074061

Author Identifiers:

Author	ResearcherID Number	ORCID Number
Gerace, Dario	L-4405-2013	
Troiani, Filippo	B-4787-2011	
Santini, Paolo	H-7341-2017	0000-0002-1182-0173
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Carretta, Stefano		0000-0002-2536-1326
GERACE, Dario		0000-0002-7442-125X

ISSN: 0031-9007

Record 19 of 19

Title: Electrically Protected Resonant Exchange Qubits in Triple Quantum Dots

Author(s): Taylor, JM (Taylor, J. M.); Srinivasa, V (Srinivasa, V.); Medford, J (Medford, J.)

Source: PHYSICAL REVIEW LETTERS **Volume:** 111 **Issue:** 5 **Article Number:** 050502 **DOI:** 10.1103/PhysRevLett.111.050502 **Published:** JUL 31 2013

Accession Number: WOS:000322728500003

PubMed ID: 23952376

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Record 1 of 9

Title: Light-induced spin polarizations in quantum rings

Author(s): Joibari, FK (Joibari, Fateme K.); Blanter, YM (Blanter, Ya. M.); Bauer, GEW (Bauer, Gerrit E. W.)

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Author	ResearcherID Number	ORCID Number
Bauer, Gerrit	F-8273-2010	0000-0002-3615-8673

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Title: Valence-band effective-potential evolution for coupled holes

Author(s): Flores-Godoy, JJ (Flores-Godoy, J. J.); Mendoza-Alvarez, A (Mendoza-Alvarez, A.); Diago-Cisneros, L (Diago-Cisneros, L.); Fernandez-Anaya, G (Fernandez-Anaya, G.)

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Author	ResearcherID Number	ORCID Number
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Record 3 of 9

Title: Aharonov-Bohm rings with strong spin-orbit interaction: the role of sample-specific properties

Author(s): Nichele, F (Nichele, F.); Komijani, Y (Komijani, Y.); Hennel, S (Hennel, S.); Gerl, C (Gerl, C.); Wegscheider, W (Wegscheider, W.); Reuter, D (Reuter, D.); Wieck, AD (Wieck, A. D.); Ihn, T (Ihn, T.); Ensslin, K (Ensslin, K.)

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Nichele, Fabrizio	K-5157-2014	0000-0002-6320-5754

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Title: In-plane mapping of buried InGaAs quantum rings and hybridization effects on the electronic structure

Author(s): Teodoro, MD (Teodoro, M. D.); Malachias, A (Malachias, A.); Lopes-Oliveira, V (Lopes-Oliveira, V.); Cesar, DF (Cesar, D. F.); Lopez-Richard, V (Lopez-Richard, V.); Marques, GE (Marques, G. E.); Marega, E (Marega, E., Jr.); Benamara, M (Benamara, M.); Mazur, YI (Mazur, Yu. I.); Salamo, GJ (Salamo, G. J.)

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Marega Junior, Euclydes	D-5250-2012	
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Title: Current-conserving Aharonov-Bohm interferometry with arbitrary spin interactions

Author(s): Lee, M (Lee, Minchul); Stepanenko, D (Stepanenko, Dimitrije)

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Record 6 of 9

Title: Generalized eigenvalue problem criteria for multiband-coupled systems: hole mixing phenomenon study

Author(s): Mendoza-Alvarez, A (Mendoza-Alvarez, A.); Flores-Godoy, JJ (Flores-Godoy, J. J.); Fernandez-Anaya, G (Fernandez-Anaya, G.); Diago-Cisneros, L (Diago-Cisneros, L.)

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Title: Anomalous spin-related quantum phase in mesoscopic hole rings

Author(s): Jaaskelainen, M (Jaaskelainen, M.); Zulicke, U (Zulicke, U.)

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Title: Discovery of a Novel Linear-in-k Spin Splitting for Holes in the 2D GaAs/AlAs System

Author(s): Luo, JW (Luo, Jun-Wei); Chantis, AN (Chantis, Athanasios N.); van Schilfgaarde, M (van Schilfgaarde, Mark); Bester, G (Bester, Gabriel); Zunger, A (Zunger, Alex)

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Title: Tunable spin currents in a biased Rashba ring

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Title: Effect of annealing conditions on the electrical properties of ALD-grown polycrystalline $BiFeO_3$ films

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Title: Local Magnetoelectric Effect in La-Doped $BiFeO_3$ Multiferroic Thin Films Revealed by Magnetic-Field-Assisted Scanning Probe Microscopy

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Author(s): Qi, XQ (Qi, Xiao-Qiu)

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Effective spin Hamiltonian of a gated triple quantum dot in the presence of spin–orbit interaction

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Abstract

We derive and study the effective spin Hamiltonian of a gated triple quantum dot that includes the effects of spin–orbit interaction and an external magnetic field. In the analysis of the resulting spin interaction in linear and in general triangular geometry of the dots, we show that the pairwise spin interaction does depend on the position of the third dot. The spin–orbit induced anisotropy, in addition to changing its strength, also changes its symmetry with the motion of the third quantum dot outside the linear arrangement. Our results present a simplified model that may be used in the design of quantum computers based on three-spin qubits.

Keywords: spin–orbit coupling, quantum dots, exchange interactions

(Some figures may appear in colour only in the online journal)

1. Introduction

Spins of electrons confined to the single-electron quantum dots have been proposed as carriers of quantum information in solid-state quantum computers [1, 2]. They were the focus of intense theoretical and experimental investigation, leading to the understanding of the mechanisms of spin interactions with the surrounding semiconductor substrate through spin–orbit interaction and hyperfine coupling to the nuclei, as well as the interaction between the spins on neighboring quantum dots [3]. Spins in single-electron quantum dots coupled by the effective spin Hamiltonian are the basis for quantum computing schemes of ever simpler control and better coherence properties.

Encoding a qubit into states of few spins offers a trade-off between the number of used quantum dots and the complexity of required control mechanisms. With the original single-spin encoding [1], implementation of the quantum gates requires control of exchange interaction between the neighboring quantum dots, as well as of the rotations of individual spins about two, preferably orthogonal, axes. The requirement for two independent axes of rotation proved to be experimentally challenging. Encoding a qubit into states of a pair of spins reduces the control requirement to the exchange interaction and rotations about a single axis. A rather useful technique for electrically controlled qubit rotations is the electric-dipole-induced spin resonance [4–7]. In this implementation, spin–orbit interaction [8–11] and nuclear spins [12–15] are typical sources of anisotropy, but they are also the main sources of spin decoherence. The control requirements are reduced even further by encoding the qubits into states of three spins. With the isotropic spin exchange interaction as the only resource, quantum computation is possible in three spin qubits encoded into states of equal total spin and equal projection of this total spin to the quantization axis [16–20]. Sequences of few tens of interaction pulses that produce a set of quantum gates sufficient for quantum computation have been found both numerically [16] and analytically [17–20].

A recently developed scheme for quantum computation, based on three-spin resonant exchange qubits, uses periodic modulation of the exchange interaction between the quantum dots to implement quantum gates [21–23]. In this and other three-spin qubits the strongest interaction, isotropic exchange $J_{ij}\mathbf{S}_i \cdot \mathbf{S}_j$ between the spins within a qubit, does not mix the logical qubit states with other states of the three spins [24].

The scheme relies on the isotropic exchange form of interaction between the spins, and on the independence of the interaction between two spins on the third one. This requirements should be well satisfied when the spin–orbit interaction is weak and when the dots that are not involved in the current spin operation are well separated from the ones that are.

The quantum dots are described in terms of interaction between their spins. Therefore, developing a simple prediction of the effective spin Hamiltonian for electrons bound to quantum dots is useful for predicting the behavior of spins in experiments. In this work, we find the effective interaction between the spins in a triplet of quantum dots that can represent either a single three-spin qubit or a pair of spins involved in a quantum gate in the presence of a third spin [25]. The model that we use includes a potential of a triple dot, Coulomb repulsion between the electrons, an external magnetic field [26] and spin–orbit interaction. As opposed to earlier work [27–29], we derive the full triple dot effective Hamiltonian suitable for description of experiments on multiple spin qubits, and do not rely on the approximation of decoupled double dot, while taking the spin–orbit interaction into account. The calculations are done at the level of Hund–Mulliken approximation, including one orbital state per quantum dot, leading to the effective Hubbard model and the low-energy effective spin Hamiltonian. We quantify the deviations of these resulting interactions from the ideal case of pairwise isotropic interactions independent from the third dot outside the pair. Spin–orbit interaction, to the lowest order, is described by the pairwise Dzyaloshinsky–Moriya interaction between the spins. The presence of the third dot leads to small changes in the interaction strength and its anisotropy. With the exception of the linear arrangement of the dots, the symmetry axis of the effective spin interaction depends on the position of the third dot. The magnetic field adds a small three-body term, in agreement with the earlier results [27–29].

In section 2 we introduce the model of triple quantum dot. In section 3 we derive the effective spin Hamiltonian for various geometries. In section 4, we discuss the isotropic interaction, and find the influence of the position of the third dot on the pairwise spin interaction. In section 5, we discuss the anisotropy in spin interaction and its variations as the geometric arrangement of the dots goes from linear to triangular. We present our conclusions in section 6.

2. Model

We consider a system of three coupled quantum dots (QDs) with three conduction band electrons bound to them. The dots are modeled by a potential with the minima at the position of the dots. Electrons in the potential minima interact through Coulomb interaction, feel the influence of the substrate through spin–orbit interaction, and move in an external magnetic field. The system Hamiltonian is

$$H = H_0 + C + H_{SO} + H_Z, \tag{1}$$

$$H_0 = \sum_{i=a,b,c} h_i, \tag{2}$$

$$h_i = \frac{1}{2m}\left(\mathbf{p}_i + q\mathbf{A}(\mathbf{r}_i)\right)^2 + V(\mathbf{r}_i), \tag{3}$$

$$C = \sum_{i\neq j} \frac{1}{4\pi\epsilon_0\epsilon_r}\frac{e^2}{|\mathbf{r}_i - \mathbf{r}_j|}, \tag{4}$$

$$H_{SO} = \sum_{i=a,b,c} H_{D,i} + H_{R,i}, \tag{5}$$

$$H_Z = \sum_{i=a,b,c} g\mu_B \mathbf{B}\cdot\mathbf{S}_i. \tag{6}$$

The single-particle noninteracting Hamiltonians h_i describe an electron in the quantum dots potential $V(\mathbf{r}_i)$, and in the magnetic field derived from the vector potential $\mathbf{A}(\mathbf{r})$. We model the potential that binds the electrons to the triple dot as

$$V(\mathbf{r}) = \sum_{i=a,b,c} \frac{m\omega_0^2}{2}\left(1 - \frac{h}{\lambda^2}\right)\left((\mathbf{r}-\mathbf{R}_i)^2 \mathrm{e}^{-\frac{m\omega_0^2}{2\lambda^2\hbar}(\mathbf{r}-\mathbf{R}_i)^2}\right) + \hbar\omega_0 h\left(1 - \mathrm{e}^{-\frac{m\omega_0^2}{2\lambda^2\hbar}(\mathbf{r}-\mathbf{R}_i)^2}\right). \tag{7}$$

This potential separates into three harmonic wells of frequency ω_0 near the minima at $\mathbf{r} = \mathbf{R}_i$, $i = a, b, c$. The effective Bohr radius of a single isolated harmonic potential at the position of a dot is $a_B = \sqrt{\hbar/m\omega_0}$. We use $\hbar\omega_0 = 3$ meV [30], a typical value obtained in the experiments. The mass m is the conduction band electron effective mass, and for GaAs quantum dots it is $m = 0.067\ m_e$, where m_e is the electron mass. The potential is parabolic in the vicinity of minima located at $\mathbf{R}_i$, and the parabolas are cut off by a Gaussian of width λa_B. The parameter h controls the depth of parabola. With parameter values $h = 3$ and $\lambda = 0.2$ the potential can host well localized and interacting spins.

Coulomb interaction of the electrons is described by C. We have used unscreened Coulomb potential with the effects of the host material described by the dielectric constant ϵ_r. For GaAs, $\epsilon_r = 13.1$.

Quantum dots are most often fabricated in two-dimensional electron gas (2DEG) within a III–V semiconductor. This typical host material for QDs shows both the Dresselhaus [31] and Rashba [32] SO interactions, and to a good approximation they are both linear in crystal momentum components. The form of SO coupling is constrained by the symmetry of the structure, and for GaAs 2DEG grown in [0 0 1] crystallographic direction it can be written as

$$H_{SO} = \mathbf{\Omega}(\mathbf{k})\cdot\mathbf{S}, \tag{8}$$

where

$$\mathbf{\Omega}(\mathbf{k}) = (-f_D k_{[100]} + f_R k_{[0\,1\,0]})\mathbf{e}_x + (-f_R k_{[1\,0\,0]} + f_D k_{[0\,1\,0]})\mathbf{e}_y, \tag{9}$$

and f_R and f_D are Rashba and Dresselhaus parameters, respectively. The values of the parameters are fixed by the substrate composition and the shape of the potential well of the 2DEG. Components of wave vectors in the crystallographic frame are expressed in our coordinate system as

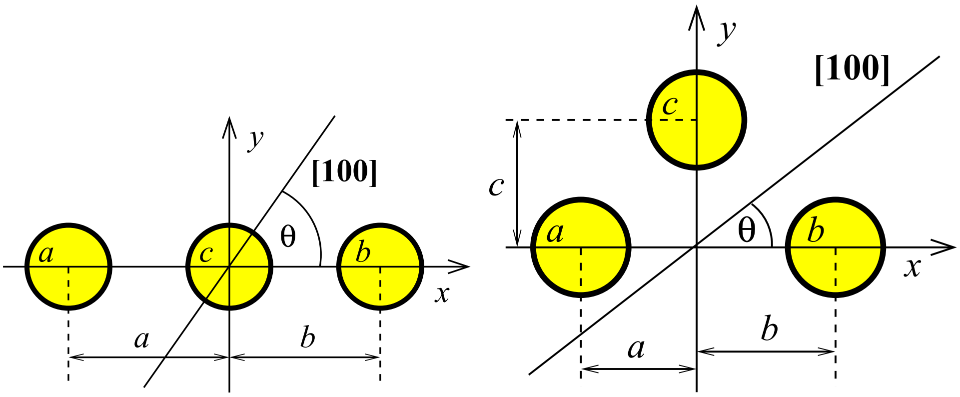

Figure 1. Geometry of the triple dot. Linear arrangement of the dots is shown in the left panel. Dots a, b and c lie on the x axis. Dot c is fixed at the origin, while the other two dots are allowed to move along the x axis. Triangular arrangement of the dots is illustrated on the right panel. Dots a and b are positioned on the x axis. The y coordinate of dot c can vary. In the magnetic field, we translate the coordinates so that the center of mass of the triple dot is at the origin. The orientation of the triple dot with respect to the crystalline axes of the substrate 2DEG in the $(0\,0\,1)$ plane of a III–V semiconductor is set by the angle θ between the x axis and the $[1\,0\,0]$ crystalline axis.

$k_{[1\,0\,0]} = \cos\theta k_x + \sin\theta k_y$ and $k_{[0\,1\,0]} = -\sin\theta k_x + \cos\theta k_y$. The geometry of the dots is described by the angle θ that the x axis makes with $[1\,0\,0]$ crystallographic direction, see figure 1.

Orbital effects of the magnetic field are due to the field component in the direction normal to the quantum dots. This field couples with electric charge through the vector potential $\mathbf{A} = \frac{B_z}{2}(-(y - Y_0), (x - X_0), 0)$, where $(X_0, Y_0, 0) = \mathbf{R}_0 = (\mathbf{R}_a + \mathbf{R}_b + \mathbf{R}_c)/3$ is the position of the center of three dots. This choice of gauge preserves the symmetry of triangular arrangements in the presence of magnetic fields. Zeeman term, H_Z, couples magnetic field and electron spins

$$H_Z = \sum_{i=a,b,c} g\mu_B \mathbf{B} \cdot \mathbf{S}_i, \tag{10}$$

where g is the g-factor ($g \approx -0.44$ for GaAs), and μ_B is the Bohr magneton. Zeeman splitting is much smaller than the relevant orbital energies $g\mu_B B_z/\hbar\omega_0 \sim 0.03$ for magnetic field of interest in this system. We can neglect the Zeeman splitting when we deal with orbital degrees of freedom and include it later in the effective Hamiltonian.

3. Effective Hamiltonian

Experiments and quantum computing schemes that involve qubits in single-electron QDs are described in terms of effective spin Hamiltonians in which each electron spin is assigned to one of the QDs in the device [15, 16, 19, 20, 33–35]. This picture is appropriate in the limit of well localized electronic orbitals with small overlaps. Orbital excitations beyond the ground state within the quantum dots are separated by an energy of the order $\hbar\omega_0$, and can be safely neglected in a typical quantum dot potential. At the second step, the doubly occupied states of the Hubbard model with a pair of electrons in total spin $S = 0$ state sharing an orbital state are also removed from the model. In this final model, the orbital state is completely defined by the dot in which the electron resides, and the only remaining degrees of freedom are spins. The effect of the virtual transitions to doubly occupied states are taken into account as an effective spin interaction. The electrons can be described by spins at the localized sites only if the Hubbard model states are localized to single dots.

An electron in the isolated QD is well described by the orbital ground state of a two-dimensional harmonic oscillator in external magnetic field. With the reduction of the dot size, the energy levels are split due to confinement. In the small dots and at low temperature, $k_B T \ll \hbar\omega_0$, the state of an electron in a quantum dot approaches the oscillator ground state in the presence of a magnetic field, i.e. the Fock–Darwin (FD) ground state [36]. Spin degrees of freedom give us two possible states which can be occupied by the electron in a FD state. That gives us 20 possible states of three electrons in three orbitals. We can divide these states in two groups according to their energies. The first group consist of eight states in which each QD is occupied by one electron, the second group is formed from 12 states where one QD is doubly occupied. We neglect the states in which all three electrons lie on a single dot, since their energy gap is larger by both the Coulomb repulsion U and an orbital excitation of the quantum dot.

Since the Coulomb repulsion between two electrons is much stronger when they occupy the same QD, the singly occupied state are low and the doubly occupied ones are high in energy. We are interested only in the eight-dimensional low-energy subspace of twenty-dimensional Hamiltonian H. These eight states encode the three-spin qubit.

The low- and high-energy space of the three-electron system are coupled by spin-independent terms of Coulomb repulsion and tunneling, as well as by the spin-dependent tunneling caused by the SO interaction. The effects of this coupling are seen as the effective interaction between the electrons in the low energy space. The states in the low-energy sector all have nominally the same orbital distribution with one spin-1/2 electron in each of the dots. Therefore, the effective low-energy Hamiltonian describes the interaction between localized spins. The Zeeman interaction does not affect the orbital states, and does not couple the low- and high-energy subspaces, so it appears in the effective Hamiltonian directly.

The Fock–Darwin ground state (FD) for harmonic confinement centered at the dot origin (x_0, y_0) is

$$\varphi(x, y) = \sqrt{\frac{m\omega}{\pi\hbar}} \mathrm{e}^{-\mathrm{i}\frac{eB_z}{2\hbar}(xy_0 - yx_0)} \mathrm{e}^{-\frac{m\omega}{2\hbar}\left((x-x_0)^2 + (y-y_0)^2\right)}, \tag{11}$$

where $\omega = \sqrt{\omega_0^2 + \frac{1}{4}\omega_c^2}$, and the cyclotron frequency $\omega_c = \frac{eB_z}{m}$ measures the orbital's magnetic compression. In the case of linear arrangement, see figure 1, we set the origin at the position of dot c, while dots a and b move along the x axis. We parameterize the triangular arrangement by putting the dots a and b along the x axis, and the dot c on the y axis. The FD states in a, b and c are φ_a, φ_b and φ_c, respectively. In a zero magnetic field, these wave functions are real.

The FD states are non orthogonal. Their overlaps, $S_{ij} = \langle\varphi_i|\varphi_j\rangle$ $(i, j \in \{a, b, c\})$, behave as

$$|S_{ij}| \propto \exp\left(-\frac{|r_{ij}|^2}{(2a_\mathrm{B})^2}\right), \tag{12}$$

quickly decaying once the interdot distance exceeds $2a_\mathrm{B}$, twice the effective single dot Bohr radius. The magnetic field in z-direction makes the overlaps complex. Explicit expressions for the overlaps are given in appendix.

The calculation of matrix elements of the three-electron Hamiltonian is simplified if the basis single-electron orbitals are orthogonal. If $\varphi = (\varphi_a, \varphi_b, \varphi_c)^T$ represents three FD states, then the transformation $\Phi = S^{-1/2}\varphi$ gives orthogonal Wannier states $\Phi = (\Phi_a, \Phi_b, \Phi_c)^T$. The resulting orthogonal basis is not unique. We have used the direct square root of the overlap matrix. Another common choice is the transformation that, in addition to producing an orthogonal basis, minimizes the spread of the resulting orbitals [37]. We choose the phases in Φ so that the states become real in the limit of vanishing magnetic field.

The Hamiltonian H, (1), acts in the space spanned by placing three electrons in the states $c_{i,s}^\dagger|0\rangle$, where the index $i = a, b, c$ counts the Wannier orbitals, and $s = \pm 1/2$ labels the spin. The matrix elements of single-particle part of H between FD states, $\langle \mathrm{FD1}|H_0 + H_\mathrm{SO}|\mathrm{FD2}\rangle$, and the matrix elements of Coulomb interaction between the pairs of FD states, $\langle \mathrm{FD1}, \mathrm{FD2}|C|\mathrm{FD3}, \mathrm{FD4}\rangle$ are calculated explicitly and presented in appendix. They are combined into matrix elements between the Wannier states. The effects of indistinguishability of the particles are accounted for by assigning the signs to the vacuum expectation value of the products of 8 creation and annihilation operators for spin-1/2 electrons in Wannier states when calculating the matrix elements of single particle operator $H_0 + H_\mathrm{SO}$, and to the products of ten operators in two-particle operator C.

Resulting Hamiltonian is the Hubbard model for three electrons in three orbitals centered at the dots positions. The effective spin Hamiltonian is found by calculating the matrix elements of the Hamiltonian H between the states of three spin-1/2 electrons in Wannier orbitals, and projecting the result to the low-energy space, using the Schrieffer–Wolff (SW) transformation up to the fourth order [38, 39]. This perturbative calculation is valid when the separation in energy between the singly- and doubly-occupied states, which is of the order of on-site repulsion U, is much larger than the matrix elements connecting the states, t. In our calculations $t/U < 0.25$.

The effective spin Hamiltonian of three localized spin-1/2 particles is

$$H = \sum_i H_i^{(1)}(\mathbf{S}_i) + \sum_{\langle i,j\rangle} H_{ij}^{(2)}(\mathbf{S}_i, \mathbf{S}_j) + H_{abc}^{(3)}(\mathbf{S}_a, \mathbf{S}_b, \mathbf{S}_c). \tag{13}$$

In the most general case, single-, two- and three-spin interactions ($H^{(1)}$, $H^{(2)}$, and $H^{(3)}$) appear in (13). The dominant terms, H_0 and C in the Hamiltonian (1) are spin-independent and the dominant spin interaction is two-electron isotropic exchange $H_{ex}(\mathbf{S}_i, \mathbf{S}_j) = J_{ij}\mathbf{S}_i \cdot \mathbf{S}_j$. The interactions are parameterized as

$$H_i^{(1)} = \mathbf{b}_i \cdot \mathbf{S}_i, \tag{14}$$

$$H_{ij}^{(2)} = J_{ij}\mathbf{S}_i \cdot \mathbf{S}_j + \mathbf{d}_{ij} \cdot (\mathbf{S}_i \times \mathbf{S}_j) + \mathbf{S}_i \cdot \Gamma_{ij} \cdot \mathbf{S}_j, \tag{15}$$

$$H_{abc}^{(3)} = \sum_{ijk} \gamma_{ijk} S_a^i S_b^j S_c^k, \tag{16}$$

where the isotropic exchange couplings J_{ij}, $i \neq j = a, b, c$ are scalars, effective magnetic fields $\mathbf{b}_i$, $i = a, b, c$, and antisymmetric anisotropies $\mathbf{d}_{ij}$, $i \neq j = a, b, c$ are vectors, symmetric anisotropies Γ_{ij}, $i \neq j = a, b, c$, are symmetric traceless rank-2 tensors, and γ_{ijk}, $i, j, k \in \{x, y, z\}$ are components of a direct product of three spin components that can combine into various rank-3 tensors. We will later use a scalar $\alpha = (1/6)\sum_{i,j,k}\varepsilon_{ijk}\gamma_{ijk}$ to parameterize the mixed product contribution to the three-spin interaction $H_\alpha^{(3)} = \alpha\mathbf{S}_a \cdot (\mathbf{S}_b \times \mathbf{S}_c)$.

Before we proceed, we expose our goals regarding the analysis of the effective spin Hamiltonian, since the coupled quantum dots system has already been exhaustively studied before. The simplest way to study this problem is to use tight-binding t-U model [27] for spin-independent terms, in which magnetic field is included through Peierls phases. The t-U model can not be used to study dependence of exchange parameters on the distance of the dots and/or the applied external magnetic field, which also affects the tunneling matrix elements. In a more detailed approach [26], magnetic field and distance dependence are incorporated in the parameters of Hubbard model. We expand on these results in two ways and focus on the case of three electrons in a triple dot that is relevant for quantum computing applications. We calculate the anisotropic exchange, parameterized by $\mathbf{d}_{ij}$, $i \neq j = a, b, c$ in the full triple-dot setup. In addition, we find that both this anisotropy and the dominant isotropic exchange parameterized by J_{ij}, $i \neq j = a, b, c$ depend on the full system geometry that includes the position of the third dot. These parameters are important in any implementation of a three-spin qubit. They quantify the deviations from the ideal case of pure isotropic exchange, and it is for this ideal form of interaction that the gate implementations were developed. Furthermore, even in the absence of accurate predictions of the intensity of resulting interactions, their symmetry may

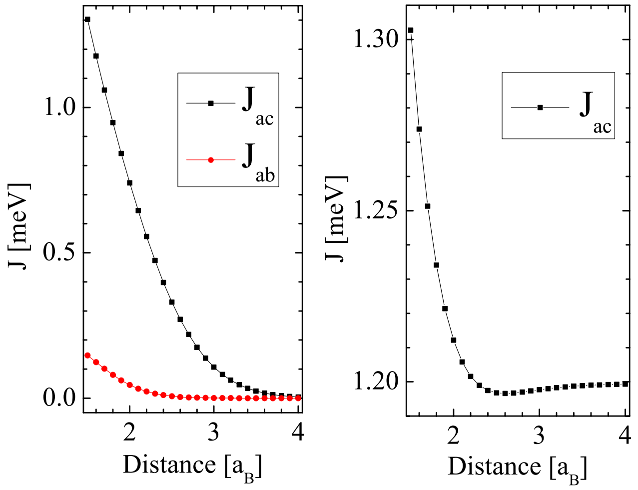

Figure 2. Exchange interaction in a linear triple quantum dot. In the left panel, exchange interaction parameters are plotted versus distance of the dots a and c in a symmetric arrangement. Dot c is fixed at the origin while the other two dots are able to move in such manner that $-a = b$. Dependence of the nearest neighbor interaction on the position of the third dot is illustrated in the right panel. For the linear arrangement of the dots with $a = -1.5a_{\mathrm{B}}$ and $c = 0$, dependence of J_{ac} versus the distance of the dots bc (going from $1.5a_{\mathrm{B}}$ to $4a_{\mathrm{B}}$) is plotted. Parameters of the potential are $h = 3$ and $\lambda = 0.2$.

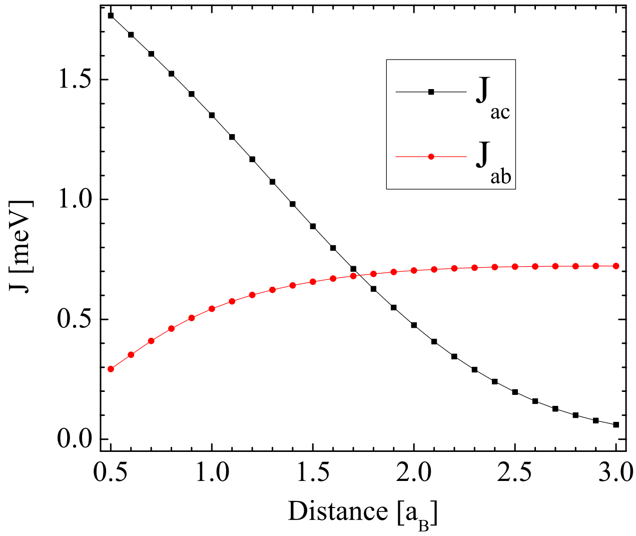

Figure 3. Exchange interaction parameters for the isosceles triangular arrangement. The plot shows the strength of exchange interaction as a function of deviation from the linear arrangement. Dot $a(b)$ is fixed at the $(-a_{\mathrm{B}}, 0)((a_{\mathrm{B}}, 0))$ and the c dot moves along the y axis from $0.5a_{\mathrm{B}}$ to $3a_{\mathrm{B}}$. In this case $J_{ac} = J_{bc}$, so only two different exchange parameters are plotted. When $c = \sqrt{3}a_{\mathrm{B}}$, equilateral geometry is achieved with $J_{ac} = J_{bc} = J_{ab}$. Parameters of the potential are $h = 3$ and $\lambda = 0.2$.

provide valuable information in designing the time-dependent spin Hamiltonians that are not affected by this deviation from the ideal. Having these goals in mind, we proceed with the analysis of the effective spin Hamiltonian.

4. Isotropic interaction

The dominant terms in our model Hamiltonian are kinetic energy, confinement and Coulomb repulsion. All of these terms are spin-independent, so they cause an effective spin interaction invariant to spin rotation. Isotropic Hamiltonian with pairwise interaction can be written in the form

$$H_{\mathrm{iso}} = J_{ab}\mathbf{S}_a \cdot \mathbf{S}_b + J_{ac}\mathbf{S}_a \cdot \mathbf{S}_c + J_{bc}\mathbf{S}_b \cdot \mathbf{S}_c, \qquad (17)$$

parameterized by the exchange interaction strengths J_{ab}, J_{ac}, and J_{bc}, as in (15). We analyze the dependence of these interactions on the geometry of the system. Raising (lowering) of the barrier height between the dots has the same effect as an increase (decrease) of the distance between them. This observation connects our results with experiments in control of the exchange strength. In the heart of the effective spin Hamiltonian approach is the requirement that orbitals of electrons are well localized at the centers of the quantum dots. Our results suggest that this condition is satisfied for $\ell > 1.5a_{\mathrm{B}}$, and in this region $t/U < 0.23$. Exchange interactions in the linear arrangement, with equal nearest neighbor distances ($\ell_{ac} = \ell_{bc} = \ell$), are present in each pair of dots, as shown in figure 2. The distance dependence reveals the influence of third dot on two-spin interaction. In contrast to the standard approach in deriving the effective Hamiltonian using the Hubbard model of an isolated pair of dots, with only nearest neighbor interaction [40], our model also includes the matrix elements between the dots a and b, leading to a new term $J_{ab}\mathbf{S}_a \cdot \mathbf{S}_b$ in the Hamiltonian. This term is smaller, but comparable to J_{ac} for the $\ell < 2a_{\mathrm{B}}$, see figure 2 (left). Since J_{ab} tends to zero much faster than J_{ac}, for $\ell > 2.5a_{\mathrm{B}}$ it can be neglected.

In QD based quantum computing the control over spins is achieved through switching the pairwise exchange interactions on and off. It is assumed that while a gate is performed between the spins on neighboring QDs, all the other spins do not interact at all. In the effective Hamiltonian (17), H_{iso}, indirect coupling terms between the two dots are present due to the existence of the third dot. Second order contributions are smaller than the direct coupling, but observable.

Pairwise interaction between neighboring quantum dots depends on the position of the third one. In (figure 2 (right)), J_{ac} is plotted as a function of distance cb, while the distance ac is fixed at $1.5a_{\mathrm{B}}$, explicitly showing the effect of the third dot. In the regime of totally decoupled third dot, exchange interaction for the double QD case is obtained. The variations of pairwise exchange coupling with the position of the third dot, show that the interaction J_{ac} can be controlled indirectly, by moving the dot b or by changing the barrier height between the dots c and b.

When the dots lie in a triangular arrangement, the relative strengths of isotropic exchange show a wider variety. We analyze these differences in an isosceles triangular arrangement (figure 3). The dots on x axis have the coordinates $(\pm a_{\mathrm{B}}, 0)$, while y coordinate of the middle dot is moved along the y axis from $0.5a_{\mathrm{B}}$ (t/U is then 0.17) to $3a_{\mathrm{B}}$. Coupling is antiferromagnetic in this case, as in the case of double dot and in the linear arrangement of triple dot. Intensities of interactions $J_{ac} = J_{bc}$ decrease and tend to zero with the separation of the middle dot. On the other hand, J_{ab} has a slight increase due to

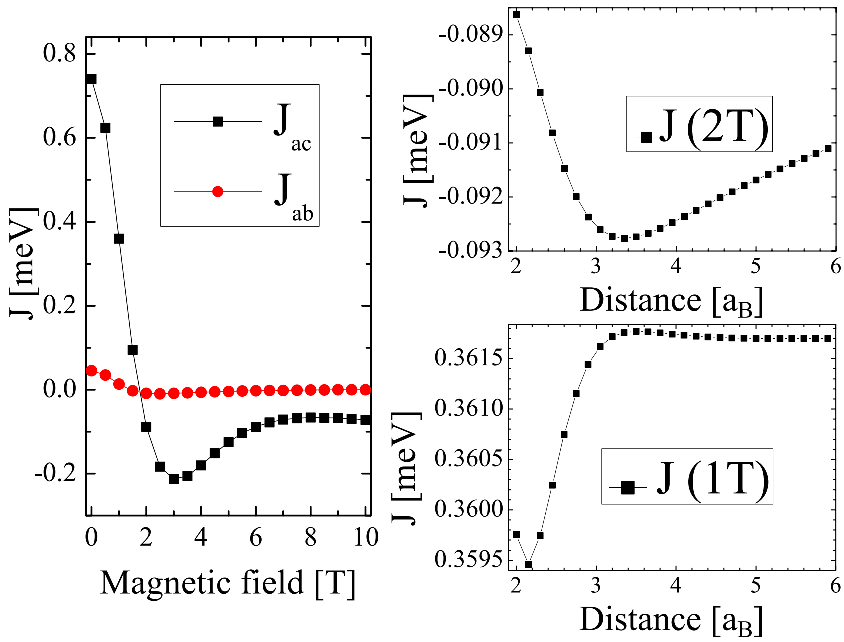

Figure 4. Exchange interaction in the magnetic field. In the linear arrangement of the dots with $ac = cb = 2a_{\mathrm{B}}$, magnetic field alters the exchange interaction, and can even change its sign, as seen in the left panel. In the right panel, exchange parameter J_{ac} ($ac = 2a_{\mathrm{B}}$) is plotted as function of the distance cb. The couplings are markedly different in external fields of 1 T and 2 T. Parameters of the potential are $h = 3$ and $\lambda = 0.2$.

the vanishing of negative hopping terms from a to b through c. Nonzero limit of J_{ab} and zero of J_{ac} suggest that we are in the regime of two dots decoupled from the third. For the equilateral arrangement ($c \approx 1.73a_{\mathrm{B}}$), $J_{ab} = J_{ac}$, as expected. The main difference with respect to the linear setup is that all three dots can contribute to the full Hamiltonian. In the equilateral case, the symmetry requires that the eigenstates are fully delocalized across the three dots, and the eigenstates of three spins are correlated across the dots [41–43].

In the presence of magnetic fields, the orbitals of quantum dots shrink, and the overlaps become complex. In the linear arrangement, low-energy Hamiltonian has the same form as (17), but the intensities and the sign of these parameters are magnetic field dependent. In (figure 4 (left)), we illustrate the exchange coupling in a linear system with $ac = cb = 2a_{\mathrm{B}}$ and the magnetic field strength going from 0 T to 10 T. In contrast to the nonmagnetic case, for magnetic field $1\ \mathrm{T} < B_z < 2\ \mathrm{T}$ we observe the transition from antiferromagnetic to ferromagnetic coupling constants due to the long-range Coulomb interaction. This transition was already observed in double quantum dots [44]. The antiferro-ferro transition can also be obtained by electrical means [45]. Magnetic field contributes to the FD states through the phase factor and magnetic squeezing, leading to a better localization of orbitals and weaker interaction. This is the reason for decline of isotropic exchange interaction strength, see (figure 4 (left)). In (figure 4 (right)) we illustrate the effect of the dot b on the exchange parameter J_{ac}. We start with the case where $ac = cb = 2a_{\mathrm{B}}$, and move b so that cb goes from $2a_{\mathrm{B}}$ to $6a_{\mathrm{B}}$. Interactions in this setup depend on the magnetic field. In contrast to the case of linear geometry, the influence of dot b on J_{ac} is weak.

In the triangular arrangement, when magnetic field is introduced, a new term,

$$H_{\alpha}^{(3)} = \alpha \mathbf{S}_a(\mathbf{S}_b \times \mathbf{S}_c), \tag{18}$$

appears in the effective Hamiltonian [27–29]. This term depends on the flux enclosed by the three dots loop, and vanishes in the linear setup. Three-spin interaction in the Hubbard model is described by the three hopping matrix elements, making it weaker than the exchange interaction by an order of magnitude. In the triangles with large surface area, electrons show more delocalization across the dots in the low-energy states. In order to localize these electrons at the dots, and make their state more similar to perfectly localized spins of spin-based quantum dot qubits, the dot separation need to be larger than in the absence of magnetic field.

This condition further means that all the gate operations are much slower than in the linear setup since exchange parameters are weaker in this case. On the other hand, three-spin term can potentially be useful for preparation of the states with three-spin entanglement. The distance dependencies of the exchange parameters ($J_{ab} = J_{ac} = J_{bc} = J$) and the three-spin interaction in the equilateral geometry are illustrated in (figure 5). Spins are decoupled for magnetic fields stronger than 2 T. In weaker fields, $B_z < 2$ T the exchange interaction and the three-spin term grow to the values that can affect the quantum computation.

5. Anisotropic interaction

The spin–orbit interaction, described by H_{SO}, introduces anisotropy into the effective spin Hamiltonian. The strongest interaction is rotationally invariant and given in (17). The weak terms describing tunneling caused by SO interaction, $|\mathbf{\Omega}|/|t| \sim 0.1$ produce a second-order correction to the isotropic exchange parameters in the effective spin Hamiltonian.

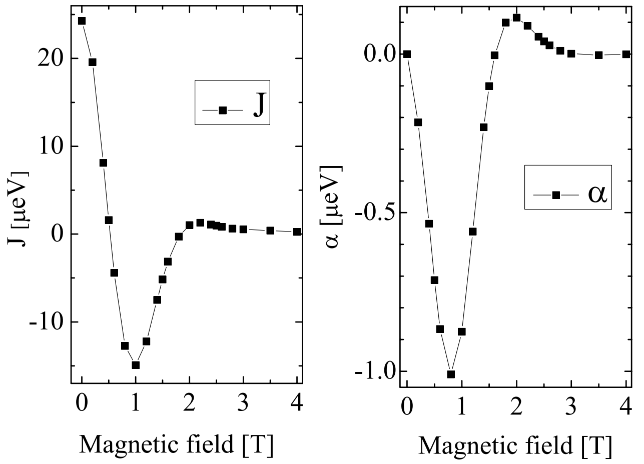

Figure 5. Exchange interaction parameter J and the three-spin term α for the equilateral triangular arrangement as a function of the magnetic field strength. Distance between the dots is $3.5a_B$. Parameters of the potential are $h = 3$ and $\lambda = 0.2$.

The dominant SO effect is the reduction of the symmetry of effective Hamiltonian, expressed as a sum of three antisymmetric Dzyaloshinsky–Moriya (DM) terms

$$H_{DM} = \mathbf{d}_{ab} \cdot (\mathbf{S}_a \times \mathbf{S}_b) + \mathbf{d}_{ac} \cdot (\mathbf{S}_a \times \mathbf{S}_c) + \mathbf{d}_{bc} \cdot (\mathbf{S}_b \times \mathbf{S}_c), \tag{19}$$

where the z components of all three $\mathbf{d}$ vectors are equal to zero. Higher-order contributions of SO interaction give the Γ-terms of $H^{(2)}$ in (15), which are another factor $|\mathbf{\Omega}|/t$ weaker than $H_{\rm DM}$. We analyze only the DM terms, being the dominant correction to the isotropic interaction. Vectors $\mathbf{d}$ originate from the orbital Hamiltonian written in a scalar product form (8). On hopping between the dots, these terms flips the component of spin $\mathbf{S}$ along the quantization axis, with or without an additional phase. The hopping amplitude and the direction of spin after hopping depend on $\mathbf{\Omega}(\boldsymbol{k})$. Matrix elements $\boldsymbol{\beta}_{ij} = \langle\varphi_i|\mathbf{\Omega}(\boldsymbol{k})|\varphi_j\rangle$ of $\mathbf{\Omega}(\boldsymbol{k})$ between FD states are calculated in appendix. Parameters $\boldsymbol{\beta}_{ij}$ depend on the geometry of the system (parameters a, b and c), overlap integrals S_{ij} between the FD states φ_i and φ_j, Rashba and Dresselhaus parameters $f_{\rm R}$ and $f_{\rm D}$, as well as on the orientation of the triple dot with respect to the crystallographic axes, as described by θ. If we scale every $\boldsymbol{\beta}$ vector by the appropriate overlap integral, we obtain a simple relation

$$\frac{\boldsymbol{\beta}_{ab}}{S_{ab}} + \frac{\boldsymbol{\beta}_{bc}}{S_{bc}} + \frac{\boldsymbol{\beta}_{ca}}{S_{ca}} = 0. \tag{20}$$

Additionally, the components of these vectors are constrained by the geometry of triple dot to satisfy relations

$$\frac{\beta^y_{ab}}{\beta^x_{ab}} = \frac{f_{\rm R}\cos\theta + f_{\rm D}\sin\theta}{f_{\rm D}\cos\theta + f_{\rm R}\sin\theta}, \tag{21}$$

$$\frac{\beta^y_{\ell c}}{\beta^x_{\ell c}} = \frac{(\ell f_{\rm R} + c f_{\rm D})\cos\theta + (-c f_{\rm R} + \ell f_{\rm D})\sin\theta}{(c f_{\rm R} + \ell f_{\rm D})\cos\theta + (\ell f_{\rm R} - c f_{\rm D})\sin\theta}, \tag{22}$$

where $\ell \in \{a, b\}$. Since every FD state centered at the observed point is the largest contributor to the Wannier state in the same dot, we expect that the relation between the components of $\boldsymbol{\beta}$ parameters in (21) is paralleled by the same relation between the components of $\mathbf{d}$ parameters scaled by the isotropic exchange interaction strengths J. We investigate this relation and find the $\mathbf{d}$ vectors as a function of the system's geometry, SO parameters $f_{\rm R}$, $f_{\rm D}$ and the orientation of the system with respect to the crystallographic axes, θ.

In the linear arrangement, the triple dot is an extension of the double quantum dot, and some of the properties of the double quantum dot [10], also hold true in this case. For example, when $f_{\rm D} = f_{\rm R}$ and $\theta = \frac{3\pi}{4}$, SO effects are equal to zero. The ratio d^y_{ij}/d^x_{ij} is independent of the dots positions,

$$\frac{d^y_{ij}}{d^x_{ij}} = \frac{f_{\rm R}\cos\theta + f_{\rm D}\sin\theta}{f_{\rm D}\cos\theta + f_{\rm R}\sin\theta}, \tag{23}$$

for every pair of dots. Our numerical analysis is performed for the Rashba and Dresselhaus parameters equal to $f_{\rm R} = 5$ meVȦ and $f_{\rm D} = 16.25$ meVȦ [46], respectively, and the angles $\theta = 0$ and $\pi/4$. For $\theta = 0$, ratio was $\frac{d^y}{d^x} = \frac{f_{\rm R}}{f_{\rm D}}$. For $\theta = \frac{\pi}{4}$, x and y component were equal, suggesting that SO vectors are along the crystallographic axis, independent on the $f_{\rm R}$ and $f_{\rm D}$. The intensities of SO vectors for the cases discussed above are plotted as functions of the nearest neighbor distance in (figure 6 (left)). The condition analogous to (20), with $\boldsymbol{\beta}$ vectors replaced by $\mathbf{d}$ vectors is never satisfied in the linear setup.

In three-spin qubits, anisotropy is an important source of deviations from the ideal behavior. We analyze the effect of the third dot on DM vector between the other two dots. In (figure 6 (right)) we show this effect for spin–orbit angles 0 and $\pi/4$ and Rashba and Dresselhaus parameters, $f_{\rm R} = 5$ meV Ȧ and $f_{\rm D} = 16.25$ meV Ȧ, respectively. The direction of DM vector does not change, but its intensity does. Orientation of the dots within the plane, described by θ, does not change the nature of this dependence, but only the intensities of $\mathbf{d}_{ij}$.

Spin–orbit coupling always influences spins in the triangular arrangement, due to the fact that all three $\boldsymbol{\beta}$ vectors cannot be zero at the same time. The vector $\boldsymbol{\beta}_{ab}$ is zero when $f_{\rm R} = f_{\rm D}$ and $\theta = 3\pi/4$, while $\boldsymbol{\beta}_{ac}$ vanishes when $f_{\rm R} = f_{\rm D}$ and $\tan\theta = \frac{c+a}{c-a}$. Condition $\boldsymbol{\beta}_{bc} = 0$ yields $f_{\rm R} = f_{\rm D}$ and $\tan\theta = \frac{c+b}{c-b}$. These requirements are compatible only when $c = 0$, i.e. with the dots in linear arrangement.

Apart from the fact that SO effects cannot be neglected, in this setup the directions of antisymmetric anisotropies $\mathbf{d}$ can vary. To illustrate this feature, we analyze the isosceles right triangle geometry (figure 7) for different orientations of the triple dot with respect to crystalline axes ($\theta = 0$ and $\theta = \frac{\pi}{4}$). In this geometry, every dot is at the same distance from the origin, $-a = b = c$ and the values of $f_{\rm R}$ and $f_{\rm D}$ are unchanged from their values in the previously considered case of aligned dots. Using the relation (21) for this geometry we find

$$\frac{\beta^y_{ab}}{\beta^x_{ab}} = \frac{f_{\rm R}}{f_{\rm D}}, \quad \frac{\beta^y_{ac}}{\beta^x_{ac}} = 1, \quad \frac{\beta^y_{bc}}{\beta^x_{bc}} = -1 \quad (\theta = 0), \tag{24}$$

$$\frac{\beta^y_{ab}}{\beta^x_{ab}} = 1, \quad \frac{\beta^y_{ac}}{\beta^x_{ac}} = \frac{f_{\rm D}}{f_{\rm R}}, \quad \frac{\beta^y_{bc}}{\beta^x_{bc}} = \frac{f_{\rm R}}{f_{\rm D}} \quad (\theta = \frac{\pi}{4}). \tag{25}$$

Our numerical results suggest that the analogous ratios of the components of $\mathbf{d}$ vectors are reached when the dots are more

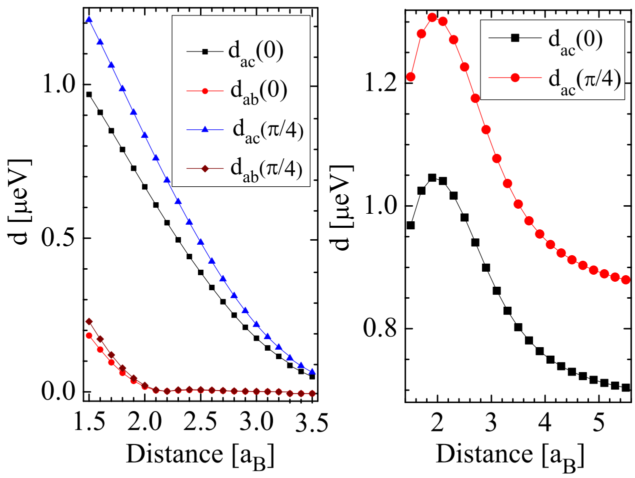

Figure 6. Dependence of anisotropy in two-spin interaction on geometry and on the orientation of linear triple quantum dot. (left) Intensity of SO parameters for the linear triple quantum dot in the cases of SO angles 0 and $\pi/4$. Dot c is fixed at the origin. Distances ac and bc are equal and vary from $1.5a_B$ to $3.5a_B$. (right) Dependence of the DM vector $\mathbf{d}_{ac}$ on the position of the dot b for SO angles 0 and $\pi/4$. Distance ac is fixed at $1.5a_B$, while distance cb varies from $1.5a_B$ to $5.5a_B$. Potential parameters are $h = 3$ and $\lambda = 0.2$. Rashba coefficient is $f_R = 5$ meV Å and Dresselhaus $f_D = 16.25$ meV Å.

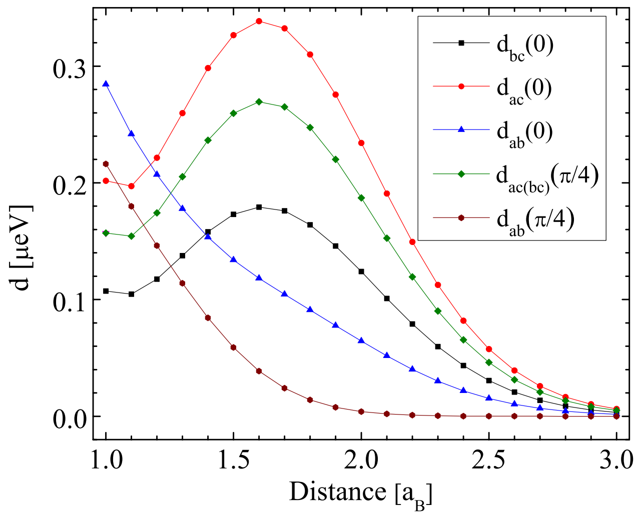

Figure 7. Intensity of SO parameters for the isosceles triple quantum dot for SO angles 0 and $\pi/4$ versus distance of each dot from the origin $(-a = b = c)$. Potential parameters are $h = 3$ and $\lambda = 0.2$. Rashba coefficient is $f_R = 5$ meV Å and Dresselhaus $f_D = 16.25$ meV Å.

than $2a_B$ apart from each other. The relation analogous to (20) is never satisfied.

Equilateral arrangement is the only setup in which equation analogous to (20) is satisfied. Due to the fact that $S_{ab} = S_{ac} = S_{bc}$, we can write it as $\boldsymbol{\beta}_{ab} + \boldsymbol{\beta}_{bc} + \boldsymbol{\beta}_{ca} = 0$. We have numerically checked that condition $\mathbf{d}_{ab} + \mathbf{d}_{bc} + \mathbf{d}_{ca} \approx 0$ holds to numerical accuracy. While this symmetry seems promising for reducing the effects of anisotropy in spin interaction on the operation of the three-spin qubit, it is always associated with the simultaneous isotropic exchange interaction of all three spins, $J_{ab} = J_{bc} = J_{ca}$. Since this interaction conserves all the quantum numbers of encoded three spin qubits, it does not produce any quantum gate.

The magnetic field normal to the plane of triple dot adds to the anisotropy of effective spin interaction, in addition to squeezing of the orbitals and introduction of phases to the overlaps. The Dzyaloshinsky–Moriya vectors are magnetic field dependent since spin–orbit Hamiltonian depends on the momentum, acquiring the term $q\mathbf{A}$ in the magnetic field. We analyze the magnetic field dependence of anisotropy in the linear geometry of a triple dot. In contrast to the zero-field case, where $\boldsymbol{\beta}$ vectors were purely imaginary and ratio of their components was real number, in a magnetic field $\boldsymbol{\beta}$ has both real and imaginary component, so the connection with $\mathbf{d}$ is less straightforward. Our numerical analysis shows that the ratios of antisymmetric anisotropy components are dependent on the magnetic field strength and the position of the third dot. In (figure 8 (left)) we plot the dependence of intensity of antisymmetric anisotropy vectors on magnetic field strength for distance $ac = cb = 2a_B$ between the dots. Intensity reaches a minimum for the fields around 1 T. In stronger fields, the intensity grows until $B_z = 3$ T, and then declines towards zero. Dependence of antisymmetric anisotropy on the position of the third dot is studied and presented in (figure 8 (right)) for magnetic fields of 2 T and 1 T.

For the triangular arrangement we were unable to make a parameterization of the dominant SO effects in terms of DM vectors. We believe that single-orbital model cannot describe the accumulated phase factor (different from 1) due to the magnetic field and SO field in the closed loop geometry. There is a way to overcome this problem by using a spin and position dependent transformation [47, 48] which is able to gauge away the linear SO terms. This was done in the case of double QD [49], in which SO effects needed to be studied in terms of eigenenergies due to the basis transformation. Since our study is done using the fixed basis and DM parameters, it is beyond the scope of this work.

The dependence of effective interaction between a pair of spins in a triple quantum dot on the position of the third one is a potential tool for experimental realization of quantum gates. In experiments on multiple dots, the gate is applied by time-dependent voltages on electrostatic gates that modify the confinement potential. As the quantum dots position coincides with the local minima of confinement potential, and the potential is locally parabolic, the small variations of gate voltages are equivalent to the motion of the dots. Therefore, a solution of time-dependent Schrödinger equation for our Hamiltonian with time dependent dot coordinates models the spin evolution driven by a time-dependent voltage.

As the spin–orbit interaction is seen as a nuisance in exchange-only quantum computing schemes, we wish to find if there is a way to remove the linear SO effects in triple QDs. It has been shown [8] that, by the proper local rotation of one spin, a double QD Hamiltonian, up to the linear SO contribution, can be written as $J(R^{\theta}_{\mathbf{u}}(\mathbf{S}_a)) \cdot \mathbf{S}_b$, where $R^{\theta}_{\mathbf{u}}$ represents a rotational matrix for an angle $\theta = |\mathbf{d}|/J$ around an axis $\mathbf{u} = (d_x, d_y, 0)/\theta J$. There is a simple prescription for removing DM terms in a linear array of QDs. Since in

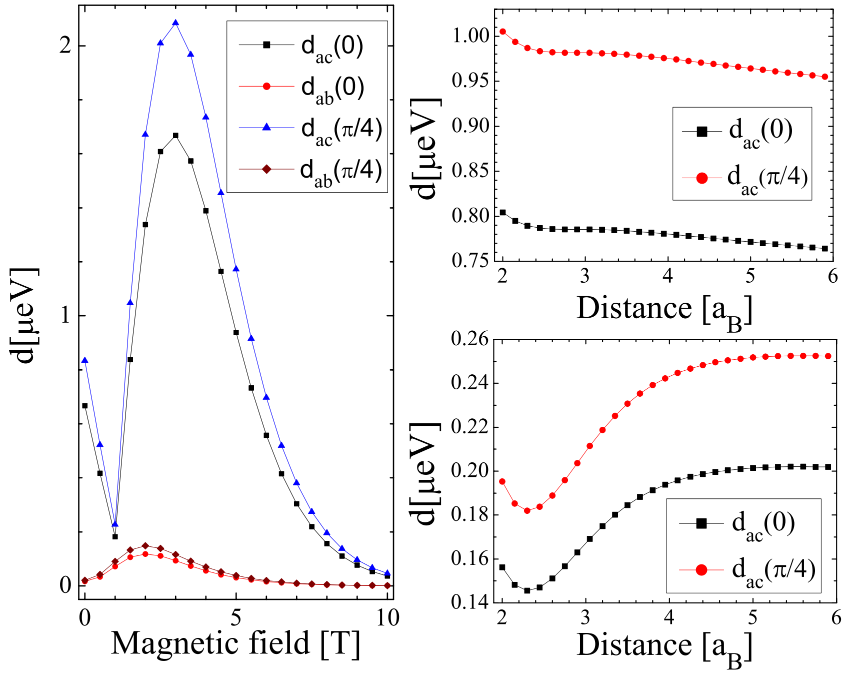

Figure 8. Dependence of two-spin interaction anisotropy on magnetic field and the position of third dot. (left) Intensity of SO parameters for the linear arrangement in the presence of perpendicular magnetic field. The geometry is set by $a(b) = -(+)2a_B$, $c = 0$. SO angles are 0 and $\pi/4$. (right) Intensity of SO parameter $\mathbf{d}_{ac}$ for the fixed distance $ac = 2a_B$ and magnetic field strengths 2 T (upper right) and 1 T (lower right) with respect to the distance cb going from $2a_B$ to $6a_B$. SO angles are 0 and $\pi/4$. Potential parameters are $h = 3$ and $\lambda = 0.2$. Rashba coefficient is $f_R = 5$ meV Å and Dresselhaus $f_D = 16.25$ meV Å .

that case nearest neighbor exchange is the dominant energy scale and the most quantum computation schemes use only this interaction [16, 18], it is enough to rotate two nearest neighbor spins in the same fashion as above. On the other hand, in triangular triple quantum dots, there is an additional freedom in the choice of time dependent interaction that implements a quantum gate. A different time-dependent Hamiltonian can be applied to each pair of spins, since now there is no clear distinction between nearest neighbor and next-nearest neighbor exchange. The question remains whether we can remove all three DM terms. We have a freedom of choice to rotate two spins in order to get rid of two DM terms: for instance, we are going to rotate spins $\mathbf{S}_b$ and $\mathbf{S}_c$ by the angles $\theta_{ab} = |\mathbf{d}_{ab}|/J_{ab}$ and $\theta_{bc} = |\mathbf{d}_{bc}|/J_{bc}$ around the vectors $\mathbf{u}_{ab} = (-d^x_{ab}, -d^y_{ab}, 0)/\theta_{ab}J_{ab}$ and $\mathbf{u}_{bc} = (-d^x_{bc}, -d^y_{bc}, 0)/\theta_{bc}J_{bc}$, respectively. Now that we have lost two DM terms, we are left with the double QD Hamiltonian of two rotated spins, $J_{bc}R^{\theta_{ab}}_{\mathbf{u}_{ab}}(\mathbf{S}_b)R^{\theta_{bc}}_{\mathbf{u}_{bc}}(\mathbf{S}_c)$. This Hamiltonian is equal to $J_{bc}\mathbf{S}_b \cdot \mathbf{S}_c + \mathbf{d}_{bc}(\mathbf{S}_b \times \mathbf{S}_c)$ if the condition

$$\frac{\mathbf{d}_{ab}}{J_{ab}} + \frac{\mathbf{d}_{bc}}{J_{bc}} + \frac{\mathbf{d}_{ca}}{J_{ca}} = 0 \qquad (26)$$

holds. Our calculation shows that equilateral triple QD in zero magnetic field satisfies (26), but does not produce a useful gate. Therefore, architectures with the linear arrangements are the only ones where exchange-only quantum computation proceeds with a simple global redefinition of spin states. In other cases, spin-nonconserving transitions to noncomputational states has to be removed.

6. Conclusions

We have studied triple quantum dot system in linear and triangular arrangements. In the linear arrangement, antiferromagnetic exchange is present between all three pairs of dots. Exchange interaction between the outer dots is smaller than the nearest neighbor exchange but comparable to it when the distances of the neighboring dots is smaller than $2a_B$. The influence of the third dot on the exchange interaction between the other two dots is considerable for both the linear and triangular system in zero magnetic field. Magnetic field suppresses this dependence on the position of third dot. At the critical field strength in the range of 1 T, we observe a transition from antiferromagnetic to ferromagnetic exchange parameters in both linear and triangular setups.

In the linear arrangement, the Dzyaloshinsky–Moriya vectors between every pair of dots point in the same direction, and depend only on Rashba (f_R) and Dresselhaus (f_D) parameters, as well as on the angle θ between the crystallographic axis and the direction connecting the dots. We have shown that Dzyaloshinsky–Moriya vector intensity between two dots is highly dependent on the position of the third one. When $f_D = f_R$ and $\theta = 3\pi/4$ the effects of spin–orbit interaction vanishes, as in the case of double dot. In the magnetic field, dependence of Dzyaloshinsky–Moriya vectors direction on magnetic field as well as on the position of the third dot is observed while Dzyaloshinsky–Moriya vectors intensity is less sensitive to the third dot than in a nonmagnetic case. Anisotropy is always present in triangular arrangements. In this setup, Dzyaloshinsky–Moriya vectors directions are additionally dependent on the third dot. For the equilateral arrangement, equation $\mathbf{d}_{ab}+\mathbf{d}_{bc}+\mathbf{d}_{ca}=0$ is satisfied, helping us to remove dominant spin–orbit effects by the proper local spin rotation of two quantum dots.

Acknowledgments

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Appendix. Details of the Hamiltonian calculation

Matrix elements of S, $\hat{x}$, $\hat{y}$, $\hat{p}_x$ and $\hat{p}_y$ between two Fock–Darwin states $\varphi_i(x,y)=\mathrm{e}^{\mathrm{i}\frac{eB_z}{2\hbar}(x_i y-y_i x)}\sqrt{\frac{m\omega}{\pi\hbar}}\mathrm{e}^{-\frac{m\omega}{2\hbar}((x-x_i)^2+(y-y_i)^2)}$ and $\varphi_j(x,y)=\mathrm{e}^{\mathrm{i}\frac{eB_z}{2\hbar}(x_j y-y_j x)}\sqrt{\frac{m\omega}{\pi\hbar}}\mathrm{e}^{-\frac{m\omega}{2\hbar}((x-x_j)^2+(y-y_j)^2)}$, centered at (x_i,y_i) and (x_j,y_j) are equal to

$$S_{ij}=\langle\varphi_i|\varphi_j\rangle=\exp\left[-\frac{4m^2\omega^2+e^2B_z^2}{16m\omega\hbar}((x_i-x_j)^2+(y_i-y_j)^2)\right]\exp[\mathrm{i}\frac{eB_z}{2\hbar}(y_i x_j-x_i y_j)], \quad (A.1)$$

$$\hat{x}^{ij}=\langle\varphi_i|\hat{x}|\varphi_j\rangle=S_{ij}\left(\frac{1}{2}(x_i+x_j)+\mathrm{i}\frac{eB_z}{4m\omega}(y_i-y_j)\right), \quad (A.2)$$

$$\hat{y}^{ij}=\langle\varphi_i|\hat{y}|\varphi_j\rangle=S_{ij}\left(\frac{1}{2}(y_i+y_j)-\mathrm{i}\frac{eB_z}{4m\omega}(x_i-x_j)\right), \quad (A.3)$$

$$\hat{p}_x^{ij}=\langle\varphi_i|\hat{p}_x|\varphi_j\rangle=S_{ij}\left(\frac{\mathrm{i}m\omega}{2}(x_i-x_j)-\frac{eB_z}{4}(y_i+y_j)\right), \quad (A.4)$$

$$\hat{p}_y^{ij}=\langle\varphi_i|\hat{p}_y|\varphi_j\rangle=S_{ij}\left(\frac{\mathrm{i}m\omega}{2}(y_i-y_j)+\frac{eB_z}{4}(x_i+x_j)\right). \quad (A.5)$$

Matrix element of H_0 (1)

$$\begin{aligned}\langle\varphi_i|H_0|\varphi_j\rangle=&\hbar\omega_0 S_{ij}-\frac{m^2\omega_0^2\omega}{2\pi\hbar}(l^p(x_i,x_j)l^s(y_i,y_j)+l^s(x_i,x_j)l^p(y_i,y_j))\\&+\frac{m\omega}{\pi\hbar}\Big[\frac{1}{2}m\omega_0^2(1-\frac{h}{\lambda^2})\sum_{k=a,b,c}(F^s(x_k,x_i,x_j)F^p(y_k,y_i,y_j)\\&+F^p(x_k,x_i,x_j)F^s(y_k,y_i,y_j))\\&+\hbar\omega_0 h(3\frac{\pi\hbar}{m\omega}S_{ij}-\sum_{k=a,b,c}F^p(x_k,x_i,x_j)F^p(y_k,y_i,y_j))\Big],\end{aligned} \quad (A.6)$$

where

$$\begin{aligned}F^p(x_k,x_i,x_j)&=\sqrt{\frac{\pi}{A}}\exp\left[-\frac{m}{2\hbar}\left(\omega(x_i^2+x_j^2)+\omega_0\frac{x_k^2}{\lambda^2}\right)+\frac{(B+\mathrm{i}E_x)^2}{4A}\right],\\F^s(x_k,x_i,x_j)&=\frac{1}{4A^2}\left[(B+\mathrm{i}E_x)^2+2A(1-2(B+\mathrm{i}E_x)x_k+2Ax_k^2)\right]F^p(x_i,x_j,x_k),\\l^p(x_i,x_j)&=\sqrt{\frac{\pi}{C}}\exp\left[-\frac{m\omega}{2\hbar}(x_i^2+x_j^2)+\frac{(D+\mathrm{i}E_x)^2}{4C}\right],\\l^s(x_i,x_j)&=\frac{1}{4C^2}\left[(D+\mathrm{i}E_x)^2+2C(1-2(D+\mathrm{i}E_x)x_j+2Cx_j^2)\right]l^p(x_i,x_j),\end{aligned} \quad (A.7)$$

with $A=\frac{m}{\hbar}(\omega+\frac{\omega_0}{2\lambda^2})$, $B=\frac{m}{\hbar}(\omega(x_i+x_j)+\omega_0\frac{x_k}{2\lambda^2})$, $C=\frac{m\omega}{\hbar}$, $D=(x_i+x_j)C$, $E_x=\frac{1}{2\hbar}(y_i-y_j)eB_z$.

Expressions $F^p(y_k,y_i,y_j)$ and $F^s(y_k,y_i,y_j)$, $l^p(y_i,y_j)$ and $l^s(y_i,y_j)$ have the same form, only the set of numbers $\{x_k,x_i,x_j\}$ is changed with the set $\{y_k,y_i,y_j\}$ and E_x is changed with $E_y=\frac{1}{2\hbar}(x_j-x_i)eB_z$.

Matrix elements of $\boldsymbol{\Omega}(\boldsymbol{k})$ (9)

$$\begin{aligned}\boldsymbol{\beta}_{ij}&=\langle\varphi_i|\boldsymbol{\Omega}(\boldsymbol{k})|\varphi_j\rangle\\&=\Big[-\frac{\hat{p}_x^{ij}+\frac{1}{2}eB_z\hat{y}^{ij}}{\hbar}(f_{\mathrm{D}}\cos\theta+f_{\mathrm{R}}\sin\theta)\\&+\frac{\hat{p}_y^{ij}-\frac{1}{2}eB_z\hat{x}^{ij}}{\hbar}(f_{\mathrm{R}}\cos\theta-f_{\mathrm{D}}\sin\theta)\Big]\boldsymbol{e}_x\\&+\Big[-\frac{\hat{p}_x^{ij}+\frac{1}{2}eB_z\hat{y}^{ij}}{\hbar}(f_{\mathrm{D}}\sin\theta\\&+f_{\mathrm{R}}\cos\theta)+\frac{\hat{p}_y^{ij}-\frac{1}{2}eB_z\hat{x}^{ij}}{\hbar}(f_{\mathrm{D}}\cos\theta-f_{\mathrm{R}}\sin\theta)\Big]\boldsymbol{e}_y.\end{aligned} \quad (A.8)$$

H_{SO} (1) matrix element between the Fock–Darwin states φ_i and φ_j with spin components included is

$$\begin{aligned}\langle\varphi_i\pm|H_{\mathrm{SO}}|\varphi_j\mp\rangle=&\Big[-\frac{\hat{p}_x^{ij}+\frac{1}{2}eB_z\hat{y}^{ij}}{\hbar}(f_{\mathrm{D}}\cos\theta+f_{\mathrm{R}}\sin\theta)\\&+\frac{\hat{p}_y^{ij}-\frac{1}{2}eB_z\hat{x}^{ij}}{\hbar}(f_{\mathrm{R}}\cos\theta-f_{\mathrm{D}}\sin\theta)\Big]\\&+\Big[\pm\mathrm{i}\frac{\hat{p}_x^{ij}+\frac{1}{2}eB_z\hat{y}^{ij}}{\hbar}(f_{\mathrm{D}}\sin\theta+f_{\mathrm{R}}\cos\theta)\\&\mp\mathrm{i}\frac{\hat{p}_y^{ij}-\frac{1}{2}eB_z\hat{x}^{ij}}{\hbar}(f_{\mathrm{D}}\cos\theta-f_{\mathrm{R}}\sin\theta)\Big].\end{aligned} \quad (A.9)$$

Coulomb interaction Hamiltonian C (1) is two-particle operator whose matrix elements between four different Fock–Darwin states positioned at $\mathbf{a}=(a_1,a_2)$, $\mathbf{b}=(b_1,b_2)$, $\mathbf{c}=(c_1,c_2)$ and $\mathbf{d}=(d_1,d_2)$ ($\varphi_t(x,y)=\mathrm{e}^{\mathrm{i}\frac{eB_z}{2\hbar}(t_1 y-t_2 x)}\sqrt{\frac{m\omega}{\pi\hbar}}\mathrm{e}^{-\frac{m\omega}{2\hbar}((x-t_1)^2+(y-t_2)^2)}$ for $t\in\{a,b,c,d\}$) is equal to

$$\begin{aligned}C_{abcd}=&\sqrt{\frac{m\omega\pi}{2\hbar}}\exp\Big[\mathrm{i}\frac{eB_z}{8\hbar}[z_1(a_2+b_2-c_2-d_2)\\&+z_2(-a_1-b_1+c_1+d_1)]\Big]\exp[\frac{e^2B_z^2}{32m\omega\hbar}(\alpha_1^2+\alpha_2^2)]\\&\times\exp[\frac{\hbar}{16m\omega}(\zeta_1^2+\zeta_2^2)]I_0(\frac{\hbar}{16m\omega}(\zeta_1^2+\zeta_2^2))\\&\times\exp\left[\frac{m\omega}{8\hbar}(|\mathbf{z}|^2-4[|\mathbf{a}|^2+|\mathbf{b}|^2+|\mathbf{c}|^2+|\mathbf{d}|^2])\right],\end{aligned} \quad (A.10)$$

where $\mathbf{z}=\mathbf{a}+\mathbf{b}+\mathbf{c}+\mathbf{d}$, $\alpha_1=a_2+b_2-c_2-d_2$, $\alpha_2=-a_1-b_1+c_1+d_1$, $\zeta_1=-\frac{m\omega}{\hbar}(b_1+d_1-a_1-c_1)+\mathrm{i}\frac{eB_z}{2\hbar}(a_2+d_2-b_2-c_2)$, $\zeta_2=-\frac{m\omega}{\hbar}(b_2+d_2-a_2-c_2)-\mathrm{i}\frac{eB_z}{2\hbar}(a_1+d_1-b_1-c_1)$.

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Dielectric and ferroelectric properties of Ho-doped $BiFeO_3$ nanopowders across the structural phase transition

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ABSTRACT

We have studied Ho-doped $BiFeO_3$ nanopowders ($Bi_{1-x}Ho_xFeO_3$, x = 0–0.15), prepared via sol-gel method, in order to analyse the effect of substitution-driven structural transition on dielectric and ferroelectric properties of bismuth ferrite. X-ray diffraction and Raman study demonstrated that an increased Ho concentration ($x \geq 0.1$) has induced gradual phase transition from rhombohedral to orthorhombic phase. The frequency dependent permittivity of $Bi_{1-x}Ho_xFeO_3$ nanopowders was analysed within a model which incorporates Debye-like dielectric response and dc and ac conductivity contributions based on universal dielectric response. It was shown that influence of leakage current and grain boundary/interface effects on dielectric and ferroelectric properties was substantially reduced in biphasic $Bi_{1-x}Ho_xFeO_3$ ($x > 0.1$) samples. The electrical performance of $Bi_{0.85}Ho_{0.15}FeO_3$ sample, for which orthorhombic phase prevailed, was significantly improved and $Bi_{0.85}Ho_{0.15}FeO_3$ has sustained strong applied electric fields (up to 100 kV/cm) without breakdown. Under strong external fields, the polarization exhibited strong frequency dependence. The low-frequency remnant polarization and coercive field of $Bi_{0.85}Ho_{0.15}FeO_3$ were significantly enhanced. It was proposed that defect dipolar polarization substantially contributed to the intrinsic polarization of $Bi_{0.85}Ho_{0.15}FeO_3$ under strong electric fields at low frequencies.

1. Introduction

Multiferroics, materials which simultaneously exhibit at least two ferroic properties among electric, magnetic, and elastic responses, are quite rare. They are of great interest for both fundamental physics and potential applications. Among multiferroic materials, bismuth ferrite ($BiFeO_3$) possesses unique property, i.e. exhibits multiferroic behavior at room temperature. Having high ferroelectric ($T_C \sim 1100$ K) and antiferromagnetic ($T_N \sim 640$ K) transition temperatures, $BiFeO_3$ is a promising material for the applications in spintronic devices, electrically controlled magnetic memories and functional sensors [1,2]. Nevertheless, problems of low resistivity and sinterability and appearance of secondary phases present a serious obstacle for the application of $BiFeO_3$ (BFO) in devices. BFO suffers from high leakage current which causes large dielectric loss and degradation of the ferroelectric properties. The main cause of leakage is disorder, usually in the form of charge defects, like oxygen or bismuth vacancies and secondary phases. Attempts at minimizing the leakage current density through doping with rare earth ions at Bi sites, have led to improvement of electric and magnetic properties of BFO [3–6]. These studies have demonstrated that substitution of Bi sites with rare-earth ions effectively controls the volatility of Bi^{3+} ions and the amount of defects, while suppressing the secondary phase appearance.

Despite a significant body of work dealing with rare-earth doped BFO [3,4,7–10], BFO doped with Ho is less investigated. There are several studies dealing with the influence of Ho doping on leakage current, and on magnetic or ferroelectric properties of BFO, for which BFO is either phase stabilized [11–16] or exhibits biphasic character with increased Ho doping [17–20]. Among these studies, only Song and coauthors [20] showed that dielectric constant was significantly increased with small amount of Ho substitution (x = 0.05, 0.10) for which BFO retained rhombohedral structure and then decreased when the orthorhombic phase appeared with higher doping (x = 0.15, 0.20). They also deduced that the dielectric loss of doped samples behaves in a complicated manner, probably influenced by the conductivity of material. Song and coauthors did not analyse the reasons of obtaining

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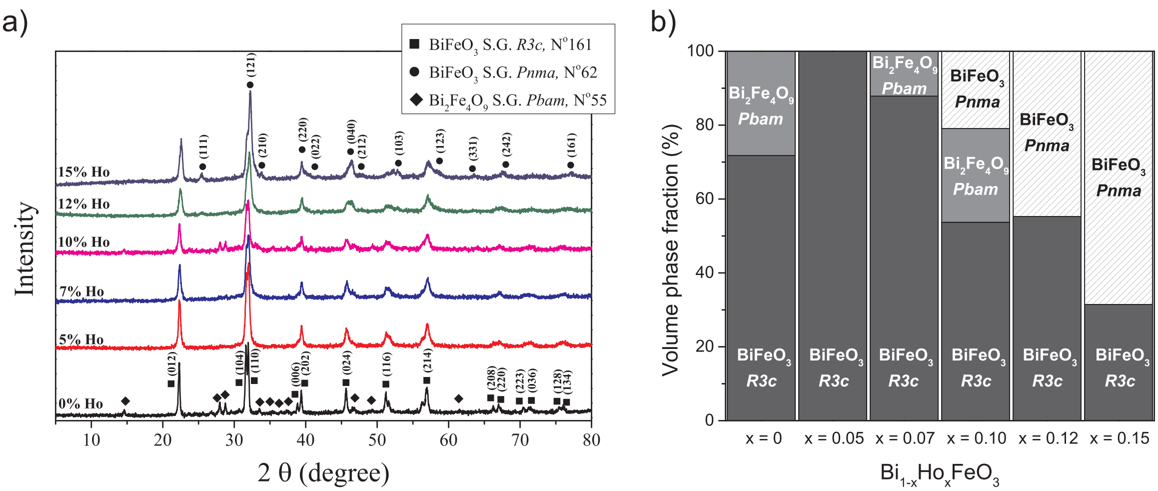

Fig. 1. a) X-ray diffraction patterns and b) volume phase fraction analysis of the $Bi_{1-x}Ho_xFeO_3$ ($0 \le x \le 0.15$) samples.

colossal dielectric constant, nor assumed that quite often these phenomena can be explained by Maxwell-Wagner-type contributions of depletion layers at the interface between sample and contacts or at grain boundaries. Furthermore, it is quite reasonable to assume that various polarization mechanisms can appear in biphasic BFO and influence the dielectric and ferroelectric properties of BFO. To the best of our knowledge, influence of structural phase transformation caused by Ho doping on polarization mechanisms, which can exert a strong influence on the dielectric and ferroelectric properties of BFO, has not been studied.

Herein, we investigated how the structural phase transformation induced by Ho doping influenced the dielectric and ferroelectric properties of $Bi_{1-x}Ho_xFeO_3$ nanopowders. Detailed analysis of the frequency dependent permittivity, using combined model which incorporated Debay-like dielectric relaxation, as well as dc and ac conductivity contributions, was performed. This analysis enabled us to estimate the influence of leakage current and grain boundary/interface effects on the dielectric and ferroelectric properties of single phase and biphasic $Bi_{1-x}Ho_xFeO_3$ nanopowders. Origin of improved electric performances of biphasic $Bi_{1-x}Ho_xFeO_3$ nanostructures, for which orthorhombic phase prevailed, was discussed in detail. These results may provide new insight into modified electrical properties of $BiFeO_3$ by Ho doping, which can be important for potential applications.

2. Experimental procedure

2.1. Materials synthesis

$Bi_{1-x}Ho_xFeO_3$ (x = 0, 0.05, 0.07, 0.10, 0.12, and 0.15) powders were synthesized by a sol-gel method. The stoichiometric amounts of bismuth nitrate ($Bi(NO_3)_3{\cdot}6H_2O$), iron nitrate ($Fe(NO_3)_3{\cdot}9H_2O$), and holmium nitrate ($Ho(NO_3)_3{\cdot}5H_2O$) were used. 2-Methoxyethanol and acetic acid (CH_3COOH) were mixed and stirred for 30 min, before adding the nitrates. Obtained solutions were stirred and heated at 80 °C. After a partial liquid evaporation, the solutions have turned into brown gels. The gels were dried for 45 min at 150 °C. Dried samples were calcinated at 650 °C for 6 h. The pristine and doped samples were named according to the Ho content as BFO, BHFO5, BHFO7, BHFO10, BHFO12 and BHFO15.

2.2. Materials characterization

The phase composition and crystal structure of $Bi_{1-x}Ho_xFeO_3$ samples were analysed using X-ray diffractometer Rigaku Ultima IV with nickel filtered Cu K_α radiation in the 2θ range of 10–80° with the step of 0.02° and the scanning rate of 0.5°/min. XRD pattern analysis was performed using Powder Cell programme (http://powdercell-for-windows.software.informer.com/2.4/) [21]. The TCH pseudo-Voigt profile function gave the best fit to the experimental data. The surface morphology was studied by scanning electron microscopy (SEM, TESCAN SM-300). The micro-Raman spectra were measured at room temperature using a Jobin Yvon T64000 spectrometer equipped with a nitrogen-cooled CCD detector. The λ = 532 nm line of solid state Nd:YAG laser was used as an excitation source with an incident laser power less than 40 mW in order to minimize the heating effects. The dielectric properties of the samples were examined in the frequency range of 80 Hz to 8 MHz. The Digital Programmable LCR Bridge HM8118 (Hameg) was used in the range 80 Hz–120 kHz, and the Digital LCR Meter 4285 A (HP/Agilent) was used in the range 80 kHz–8 MHz. Each sample was placed in a closed capacitor cell housed in a Faraday cage with an AC signal of 1.5 V applied across the cell. The disk-shaped samples had a diameter close to the diameter of the cell electrodes (8 mm). Standard bipolar measurements in the frequency range 1 Hz–1 kHz were performed on Precision Multiferroic Test System (Radiant Technologies, Inc.), using a triangular electric field waveform. All measurements were performed at room temperature.

3. Results and discussion

Fig. 1(a) shows XRD patterns of the $Bi_{1-x}Ho_xFeO_3$ ($0 \le x \le 0.15$) samples. The XRD pattern of pristine BFO matches the rhombohedral *R3c* structure with a presence of weak diffraction peaks which correspond to the orthorhombic $Bi_2Fe_4O_9$ secondary phase of *Pbam* space group (N° 55, ICSD #20067). XRD spectra of the BHFO5 and BHFO7 samples maintain *R3c* structure. No secondary peaks were detected in BHFO5 sample, whereas the traces of secondary phase were observed in the BHFO7 sample. Addition of Ho dopant induced a gradual broadening of XRD peaks and their shifts towards higher angles. These changes suggest structural distortion of BFO lattice and can be attributed to the unit cell contraction due to the substitution of Bi^{3+} ions with smaller Ho^{3+} dopant. Significant changes with increased Ho concentration were observed in doublet (104) and (110) diffraction peaks at 2θ ~ 32°. These peaks were shifted towards larger 2θ values, and in the samples with higher Ho content (x > 0.07) they gradually merged into a single broad peak (BHFO15 sample). In addition, the (006), (116) and (202) diffraction peaks of *R3c* phase became weak and disappeared in the samples with higher Ho concentration (x > 0.1). In the spectra of BHFO12 and BHFO15 samples, a new single peak appeared at 2θ ~ 38°, whereas additional peak at 2θ ~ 25° was found in BHFO15 sample.

Such changes have already been seen in the XRD spectra of doped

Table 1
The lattice parameters (Å), volume of the unit cell (Å^3) and volume phase fraction (vol%).

Phase	BFO	BHFO5	BHFO7	BHFO10	BHFO12	BHFO15
$BiFeO_3$ rhombohedral *R3c*	a = 5.5722 c = 13.8511 V = 372.45 71.75%	a = 5.5636 c = 13.8216 V = 370.51 100.00%	a = 5.5575 c = 13.8145 V = 369.51 87.86%	a = 5.5651 c = 13.8143 V = 370.51 53.72%	a = 5.5675 c = 13.8542 V = 371.91 55.27%	a = 5.5441 c = 13.8127 V = 367.68 31.45%
$Bi_2Fe_4O_9$ orthorhombic *Pbam*	a = 7.9477 b = 8.4582 c = 6.0050 V = 403.68 28.25%	/	a = 7.9769 b = 8.5299 c = 5.9448 V = 404.50 12.14%	a = 7.9501 b = 8.4580 c = 5.9976 V = 403.29 25.36%	/	/
$BiFeO_3$ orthorhombic *Pnma*	/	/	/	a = 5.5830 b = 7.8825 c = 5.4192 V = 238.49 20.92%	a = 5.5993 b = 7.8679 c = 5.4540 V = 240.27 44.73%	a = 5.5907 b = 7.8129 c = 5.4297 V = 237.17 68.55%
Rp	5.81	6.27	5.94	4.86	6.18	5.42
Rwp	7.44	7.92	7.60	6.14	7.92	6.91
Rexp	0.11	0.12	0.09	0.06	0.07	0.09

$BiFeO_3$ nanoparticles [17,22], ceramics [23–25] and films [26], and were ascribed to the presence of orthorhombic phase. All these notable changes in the XRD spectra indicate structural phase transformation from rhombohedral to orthorhombic phase in the samples doped with higher Ho content (x = 0.10, 0.12 and 0.15). $Bi_2Fe_4O_9$ phase is still present in the BHFO10 sample, but with further increase of Ho doping (BFHO12 and BFHO15 samples) the secondary $Bi_2Fe_4O_9$ phase is completely suppressed. Furthermore, the absence of diffraction peaks which correspond to Ho oxides, even at higher concentrations, implies that Ho ions have entered substitutionally into BFO lattice.

The measured XRD patterns were further refined using PowderCell programme in order to calculate the structural parameters and estimate the volume fraction of each phase. The best fits of the measured data were obtained using rhombohedral *R3c* structure for BHFO5 and BHFO7 samples. The orthorhombic phase appeared in BHFO10 samples and with further Ho doping this phase becomes dominant in BHFO15 sample. Unit cell parameters and the estimated volume fractions of different phases are presented in Table 1 for pristine and Ho-doped BFO samples. The decreasing trend in lattice constants and the unit cell contraction of *R3c* phase confirm that Bi^{3+} ions are substituted with smaller Ho^{3+} ions. A similar behavior has been reported in Tb-doped $BiFeO_3$ [10] as well as in rare-earth doped $BiFeO_3$ ceramics [27,28]. The slight increase of *R3c* phase lattice parameters in BHFO10 and BHFO12 samples can be ascribed to increased strain at phase boundary between rhombohedral and orthorhombic crystal structure. Levin et al. have also found abrupt expansion of the *R3c* unit cell volume at the rhombohedral-orthorombic phase transition in Nd-substituted $BiFeO_3$ [29]. The results of quantitative phase analysis of the $Bi_{1-x}Ho_xFeO_3$ samples are presented in Fig. 1(b).

The influence of structural changes on surface morphology of BFO is illustrated in Fig. 2, where the SEM images of pristine and BHFO15 samples are shown for comparison. Changes in the surface morphology are clearly visible. Certain amount of intergranular porosity and non-uniformity of particles can be observed in the BFO sample, including very small spherical particles and big clumps. With incorporation of Ho^{3+} ions in BFO, the particles became more uniform and compact, whereas the particle size was reduced, as seen in 10% Ho-doped BFO [30]. In the enlarged images (Fig. 2c and d) it can be seen that pure and Ho-doped BFO samples consist of small particles and large irregularly shaped agglomerates.

Changes of $Bi_{1-x}Ho_xFeO_3$ crystal structure are reflected in the changes of $BiFeO_3$ vibrational properties, i.e. through the changes in intensity, position, and width of the Raman modes. Fig. 3 shows the room-temperature Raman spectra of $Bi_{1-x}Ho_xFeO_3$ samples. Raman spectrum of undoped $BiFeO_3$ was deconvoluted using Lorentzian profiles and all 13 Raman active modes ($4A_1+9E$) of the rhombohedral $BiFeO_3$ [31] are observed. The most prominent Raman modes for *R3c* structure (marked as E-1, A_1-1, A_1-2, and A_1-3) are positioned at 75, 140, 171, and 218 cm^{-1}, respectively and are related to Bi–O bonds. The A_1-4 mode at 430 cm^{-1} and eight E modes at 124, 274, 344, 369, 468, 520, 550 and 598 cm^{-1} with quite weak scattering intensity are related to Fe–O bonds.

Raman spectroscopy is sensitive to atomic displacements. The A_1-1, A_1-2 and A_1-3 modes are blue-shifted due to the substitution of Bi^{3+} ions with smaller Ho^{3+} ions. Modes E-1, A_1-1, A_1-2 and A_1-3 became broader and of reduced intensity, whereas higher frequency E modes (E-4, E-5) have almost disappeared. The peak broadening and reduced intensities of Raman modes imply the distortion of rhombohedral structure with incorporation of Ho. With increasing Ho concentration ($x \geq 0.1$), further changes in the Raman spectra are the result of decreased stereochemical activity of Bi lone electron pair. The intensities of A_1 and E modes are drastically reduced in BHFO10 and BHFO12 samples. These modes are barely visible in the Raman spectra of BHFO15 sample. Moreover, in BHFO12 sample three new modes approximately at 300, 400, and 510 cm^{-1}, are observed. Reduced intensities of phonon modes, characteristic for rhombohedral phase, and the presence of additional modes suggest the appearance of new crystalline phase. In the Raman spectrum of BFHO15 sample which is significantly different from the spectrum of pristine BFO, the most prominent modes are at ~ 300, 400, and 510 cm^{-1}. These modes are characteristic for orthorhombic perovskite $LaMnO_3$ and $YMnO_3$ structures [32] and are also observed in doped BFO powders [17]. All notable changes in the Raman spectra of BHFO12 and BHFO15 samples are consistent with the results of XRD analysis, confirming a structural transformation from rhombohedral to orthorhombic paraelectric phase. Hence, Raman spectroscopy is powerful tool for detecting changes of Bi–O covalent bonds during the phase transition.

Fig. 4(a) and (b) illustrate the frequency dependence of real (ε') and imaginary (ε'') part of the complex permittivity ε of $Bi_{1-x}Ho_xFeO_3$ samples. In the lower frequency range, both ε' and ε'' decrease with increasing frequency and become nearly constant at higher frequencies. Among the samples with *R3c* structure, BHFO5 sample has shown pronounced dispersion at lower frequencies and higher values of ε' and ε'' than BFO. The BHFO7 sample displayed almost no dispersion over the whole frequency range. Among the samples with higher Ho content in which orthorombic phase appears, BHFO10 sample displayed more dispersive characteristic than BHFO12 and BHFO15 samples for which permittivity dispersions were negligible.

BFO nanostructures in the form of nanopowders or thin films usually suffer from large leakage current due to the presence of oxygen vacancies, Fe^{2+} ions or some other impurities. The inhomogeneity of BFO microstructure and composition originates from the regions with

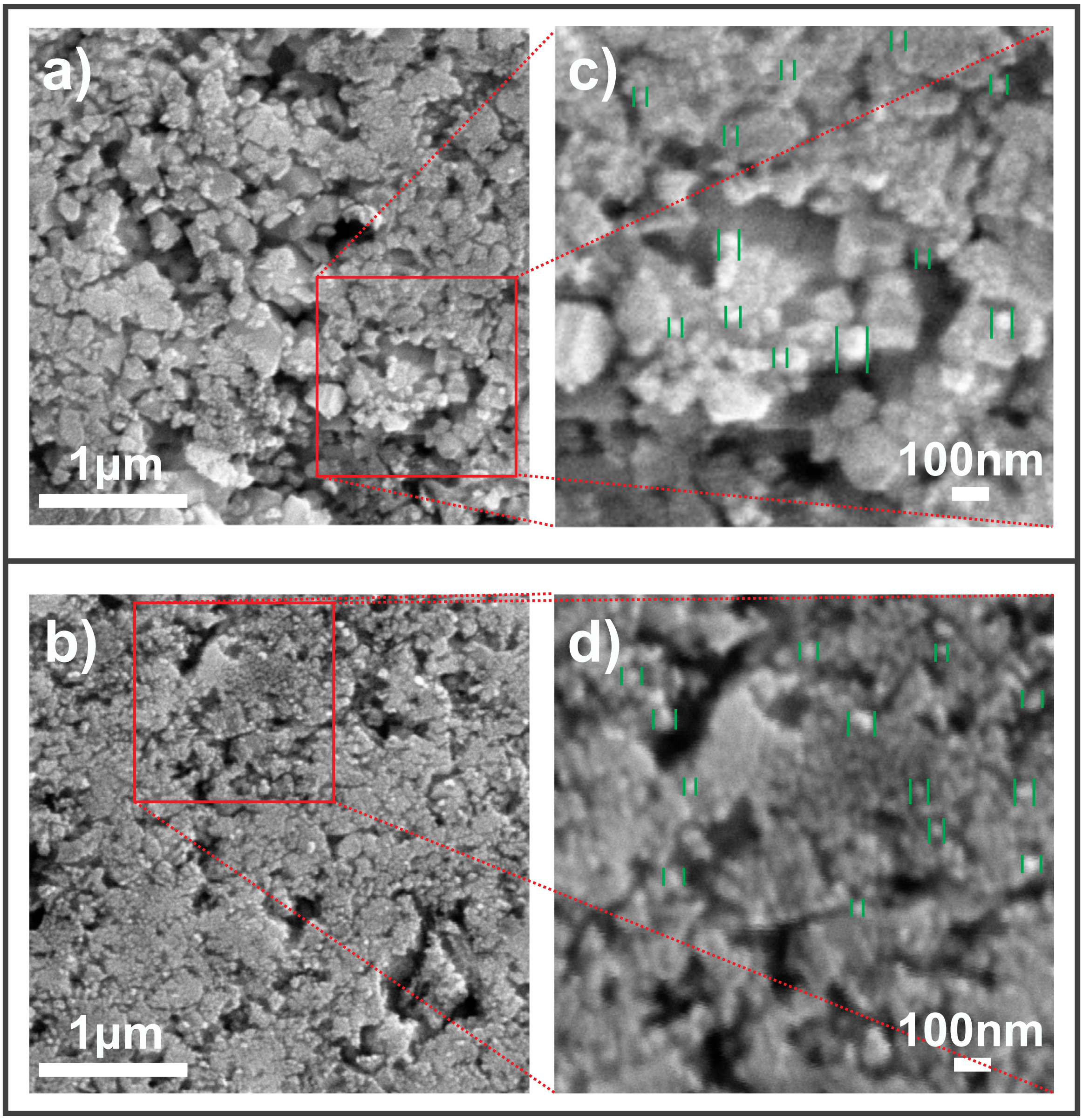

Fig. 2. SEM images of a) $BiFeO_3$ and b) $Bi_{0.85}Ho_{0.15}FeO_3$ samples. High-magnification SEM images of the c) $BiFeO_3$ and d) $Bi_{0.85}Ho_{0.15}FeO_3$ samples.

different conductivity, for example bulk and grain boundaries or from depletion layers formed at the interface of the electrode/sample surface. In addition to the dipolar or orientational polarization which occurs in the frequency range of 10^3–10^6 Hz, the grain boundary or interface effects give rise to the Maxwell-Wagner polarization which can substantially contribute to the permittivity and its dispersion at lower frequencies [3].

The dielectric relaxation processes in pure and Ho-doped BFO nanopowders were analysed within a model which includes Cole-Cole empirical expression, dc and ac conductivity terms. This model describes dielectric relaxation processes due to dipole relaxation, and the contributions from leakage current and grain boundary/interface effects. The advantages of this model for analyzing the dielectric properties of pristine $BiFeO_3$ films have been shown by Li and coworkers [33]. The total complex permittivity is of the form [33,34]:

$$\varepsilon = \varepsilon' + i\varepsilon'' = \frac{\varepsilon_s - \varepsilon_\infty}{1+(i\omega\tau)^{1-\alpha}} + \frac{\sigma_0}{\varepsilon_0} tan\left(\frac{\pi s}{2}\right)\omega^{s-1} + i\left(\frac{\sigma_{DC}}{\omega\varepsilon_0} + \frac{\sigma_0}{\varepsilon_0}\omega^{s-1}\right) \quad (1)$$

The first term in Eq. (1) corresponds to the Cole-Cole formula, where ε_s and ε_∞ are static and high frequency dielectric permittivity, τ is the relaxation time, andα, taking the value between 0 and 1, describes the distribution of relaxation times. For an ideal Debye relaxation $\alpha = 0$. For $\alpha < 0$ the loss peaks are broader and deviate in shape from the symmetric Debye peak [35]. The frequency-independent dc conductivity contributes only to the imaginary part of permittivity (ε'') through the term $\sigma_{DC}/\omega\varepsilon_0$, whilst the frequency-dependent ac conductivity represented by UDR ansatz [34,35], influences both ε' and ε'' through terms $(\sigma_0/\varepsilon_0)tan\left(\frac{\pi s}{2}\right)\omega^{s-1}$ and $(\sigma_0/\varepsilon_0)\,\omega^{s-1}$, where σ_0 is a pre-power term and s is a frequency exponent which takes values between 0 and 1.

The fits of $\varepsilon'(\omega)$ and $\varepsilon''(\omega)$, based on Eq. (1), are presented with solid lines on Figs. 4(a) and 4(b) and the values of fit parameters for $Bi_{1-x}Ho_xFeO_3$ samples are summarized in Table 2. The values of σ_{DC} and σ_0 for $Bi_{1-x}Ho_xFeO_3$ samples, based on the fitting results, are presented in Fig. 4(d). BFO sample has relatively high σ_{DC} value of $6.1{\cdot}10^{-9}\ \Omega^{-1}\ cm^{-1}$, whereas the value of σ_0 is an order of magnitude lower. These values are comparable with reported data [15,33,36]. It can be concluded that the permittivity of BFO sample is dominated by the leakage current contribution, whereas the ac dependent mechanisms are less prominent. Among the Ho-doped samples with *R3c*

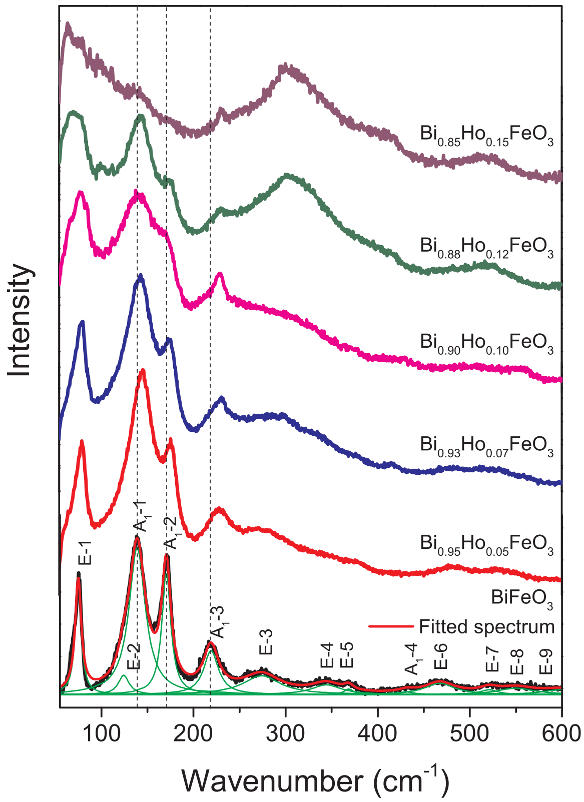

Fig. 3. Room-temperature Raman spectra of the $Bi_{1-x}Ho_xFeO_3$ ($0 \le x \le 0.15$) samples together with the deconvoluted Raman spectrum of pristine $BiFeO_3$.

structure, the highest dc and ac conductivity exhibits the BFHO5 sample, meaning that leakage current and grain boundary or interface effects can be a cause of permittivity dispersion and its higher value at lower frequencies. This finding offers an explanation for the collosal dielectric constant of Ho doped samples found by Song et al. [20]. The σ_{DC} and σ_0 values of BHFO7 sample are much lower than in BFO and BHFO5 samples. Despite the fact that the amount of secondary phase in BFHO7 is almost the same as in pristine BFO and having in mind that BFHO5 sample is phase pure, it seems that BHFO5 and BFO samples are more conductive than BHFO7 sample. This fact can explain the flat frequency dependence of $\varepsilon'(\omega)$ and $\varepsilon''(\omega)$ (Figs. 4(a) and (b)) of BHFO7 sample and imply that the presence of secondary phase has no great influence on the BFO conductivity, but defects in the form of oxygen vacancies and grain boundary or interface effects play a major role in the conductivity of BHFO5 and BFO samples. A significant increase of σ_{DC} value, which is almost twice as large as in pristine BFO and BHFO5 samples, was found in a case of BHFO10. Although it is expected that increased Ho doping reduces the leakage current due to the suppressed concentration of oxygen and bismuth vacancies, this sample seems to be more leaky than the pristine BFO. The σ_{DC} value, higher than in all the other samples, and pronounced dispersion of $\varepsilon''(\omega)$ implies that the leakage current affects the dielectric properties of BHFO10 to a great extent.

The changes in dielectric properties of BHFO10 sample can be related to the appearance of orthorhombic phase, because the dielectric properties are dependent on the sample structure and therefore can be modified near the phase transformation boundary [3]. The dc and ac conductivities were significantly reduced in BHFO12 sample, whereas BHFO15 sample, for which orthorhombic phase prevails, had an order of magnitude lower dc conductivity ($5.7{\cdot}10^{-10}\,\Omega^{-1}\,cm^{-1}$) than the BFO ($6.1{\cdot}10^{-9}\,\Omega^{-1}\,cm^{-1}$). Therefore, we argue that higher Ho content reduces the leakage current, and weakens the ac conductivity contribution to the dielectric response. The frequency dependence of dielectric loss ($tan\,\delta$) of $Bi_{1-x}Ho_xFeO_3$ samples is presented in Fig. 4(c). The dielectric loss follows a trend similar to the permittivity in the frequency range of 100 Hz to 8 MHz, i.e. it decreases with increasing frequency. The BFO, BHFO5 and BHFO10 samples have higher $tan\,\delta$ value than other Ho-doped samples with pronounced dispersion at lower frequencies. There is an indication of dielectric relaxation peak in conductive BFO and BHFO10 samples at frequency of 5 kHz, which can be ascribed to the carrier hopping process between Fe^{2+} and Fe^{3+} ions inside the particles [37] or to the hopping along the Fe^{2+}-$V_O^{\bullet}$ -Fe^{3+} chain [38]. This peak is slightly shifted to lower frequency in BHFO5 sample. This low frequency relaxation can be attributed to the grain boundary conduction [39]. Reduced $tan\,\delta$ values and the absence of relaxation peaks in BHFO7, BHFO12 and BHFO15 samples point at an increased resistivity of these samples.

Polarization-electric field (P-E) hysteresis loops of $Bi_{1-x}Ho_xFeO_3$ samples, measured at frequency of 100 Hz, are presented in Fig. 5(a). The BFO sample has an unsaturated P-E loop due to non negligible contribution of leakage current ($\sigma_{DC} = 6.1{\cdot}10^{-9}\,\Omega^{-1}\,cm^{-1}$). The maximal polarization, remnant polarization (P_r), and coercive field (E_c) reached the highest values in BFO sample and decreased with Ho-doping. The BHFO5 sample has a pinched P-E loop, characteristic for leaky materials. The permittivity analysis has shown that BHFO5 is less resistive than BFO and that grain boundary effects and leakage current dominate its dielectric properties. Therefore, the degraded ferroelectric properties can be attributed to the presence of oxygen vacancies and valence fluctuations of Fe ions (between Fe^{3+} and Fe^{2+}), because the appearance of oxygen vacancies and Fe^{2+} ions, especially at grain boundaries, is unfavorable for the polarization switching. The study of dielectric properties has shown that BHFO7 is more resistive than BFO and BHFO5. This fact explains slightly improved P-E loop compared to BHFO5 sample, but still lower P_r and E_c values than in BFO can originate from a decrease in stereochemical activity of Bi lone electron pair with increase of Ho content. P-E loops of the BHFO10, BHFO12 and BHFO15 samples are very similar to the P-E loops of BHFO5 sample. The degraded ferroelectricity of BHFO10 mainly originates from the contribution of dc conductivity (σ_{DC}) which is the highest among all analysed samples (see Fig. 4(d) and Table 2). Although BHFO12 and BHFO15 samples are more resistive than BFO and all the other Ho-doped samples, their ferroelectric properties are degraded because of the possible appearance of paraelectric phase regions in highly Ho doped BFO. This is supported by the changes noticed in the Raman spectra of these samples. Near the ferroelectric-paraelectric phase transition, the intensities of the Raman modes characteristic for Bi–O bonds [28] were reduced in BHFO12 sample and have almost disappeared in BHFO15 sample.

Furthermore, the presence of orthorhombic phase increases the breakdown field strength of $Bi_{1-x}Ho_xFeO_3$ samples (inset of Fig. 5(a)). The breakdown in BFO and $Bi_{1-x}Ho_xFeO_3$ samples with rhombohedral structure ($x < 0.1$) happens at the applied electric fields of around 20 kV/cm. The BHFO10 and BHFO12 samples, in which rhombohedral and orthorhombic phase coexist, withstand applied fields that are approximately twice as high. The BHFO15 sample in which orthorhombic phase prevails, withstands even higher electric fields (> 50 kV/cm) without breakdown (marked with arrow on the inset). The reason can be found in reduced dc conductivity of BHFO15 and in increasing number of Ho–O bonds with large bond energy, almost two times larger than the Bi–O bond [15]. Knowing that BHFO15 sample withstands high external fields without breakdown, the P-E loops of BHFO15 sample were measured at different testing frequencies from 2 Hz to 100 Hz under the applied field of 50 kV/cm, as shown in Fig. 5(b). It is obvious that P-E loops exhibit frequency-dependent behavior by showing rapid increase of P_r, E_c and maximal polarization at lower frequencies. Frequency dependence of the $2P_r$ for BHFO15 sample is presented in the top-left inset of Fig. 5(b), from which it is clear that $2P_r$ has the highest value of 0.21 μC/cm^2 at 2 Hz and rapidly decreases to 0.07 μC/cm^2 at 20 Hz. The P-E loops of BHFO15 measured in a high amplitude electric field of 100 kV/cm and at low frequencies of 1 Hz

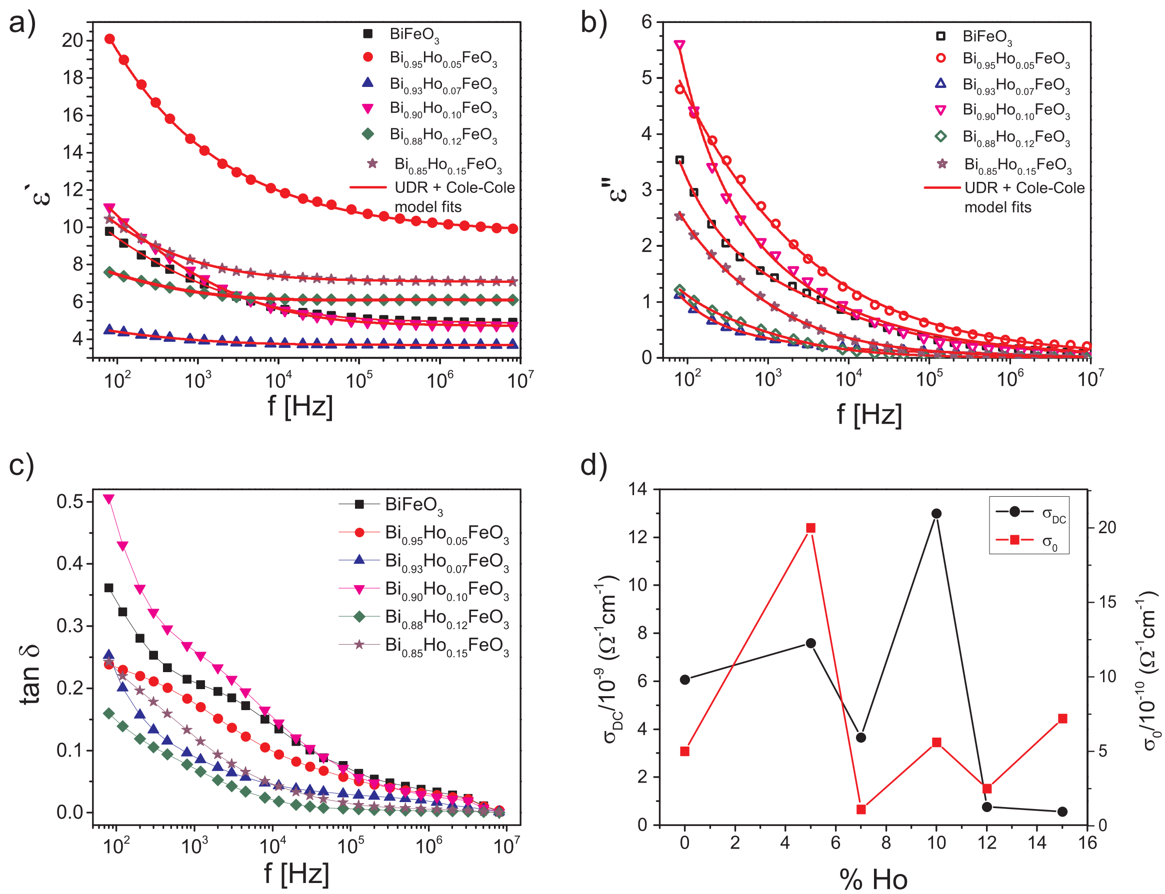

Fig. 4. Room-temperature (a) real (ε') and (b) imaginary (ε'') part of the complex permittivity. Full lines present the corresponding fits applying the combined model (Eq. 1), (c) loss tangent (*tan δ*) and (d) the dependence of σ_{DC} and σ_0 values on Ho content for $Bi_{1-x}Ho_xFeO_3$ samples.

and 2 Hz are presented in the right-bottom inset of Fig. 5(b). The $2P_r$ value is larger by a factor of two than the one obtained at the same frequency in the field of 50 kV/cm. Such a behavior can be explained by the effect of external field on the reorientation of defect dipoles and their role in domain wall switching in BFO. The presence of mobile, single defects (like $V_{Bi}^{'''}$, $V_O^{\bullet}$ or $V_O^{\bullet\bullet}$) or defect complexes (oxygen vacancy-cation associated dipoles) in BFO plays an important role in the domain wall pinning. It leads to the deterioration of polarization-switching properties by suppression of intrinsic polarization and increase of leakage current. The ferroelectric domain depinning can be achieved by applying high electric field or can be favoured at elevated temperatures and a secondary re-oxidation annealing [40–43]. On the other hand, in high electric fields the defect complexes can orient along the direction of spontaneous polarization and follow the domain switching, enhancing polarization properties of BFO [42–45]. Inherent defect dipoles are expected not to switch during fast field cycling, since their reorientation takes more time than the domain switching process. Therefore, the influence of defect dipole polarization on the overall polarization can be seen in high fields at low frequencies, as defect complexes can keep up with reversal of the field and contribute to the bulk ferroelectric polarization [40,44]. It is plausible to suppose that inherent defect complexes like $V_{Bi}^{'''} - V_O^{\bullet\bullet}$, $Fe'_{Fe^{2+}} - V_O^{\bullet}$ or $Fe'_{Fe^{2+}} - V_O^{\bullet\bullet}$ form during the crystallization process in $Bi_{1-x}Ho_xFeO_3$ samples. Among all $Bi_{1-x}Ho_xFeO_3$ samples, only BHFO15 sample has supported high external field of 50 kV/cm which can induce defect dipole reorientation. By applying strong external field at low frequencies, defect dipoles can orient along the direction of spontaneous polarization following the domain switching. With increasing of the field strength to 100 kV/cm and by lowering the frequency to 1 Hz, the effect of defect dipolar polarization was more pronounced. Therefore, the reorientation of internal defect complexes under high external field gives rise to the enhancement of intrinsic polarization of BHFO15 sample.

4. Conclusions

In summary, the phase transformation from rhombohedral to orthorhombic phase induced by increased Ho substitution, affected to a great extent the dielectric and ferroelectric properties of $Bi_{1-x}Ho_xFeO_3$ nanopowders. The frequency dependent permittivity was analysed using combined model which incorporated Debye-like dielectric

Table 2
The fitting parameters for $Bi_{1-x}Ho_xFeO_3$ samples obtained from combined model.

Parameter	BFO	BHFO5	BHFO7	BHFO10	BHFO12	BHFO15
α	0.55	0.69	0.65	0.69	0.60	0.67
τ(s)	$5.3 \cdot 10^{-6}$	$2.2 \cdot 10^{-6}$	$5.2 \cdot 10^{-5}$	$1.2 \cdot 10^{-5}$	$5.6 \cdot 10^{-5}$	$3.2 \cdot 10^{-5}$
s	0.79	0.66	0.80	0.85	0.78	0.75
$\sigma_0(\Omega^{-1}\,cm^{-1})$	$5.0 \cdot 10^{-10}$	$1.8 \cdot 10^{-9}$	$1.1 \cdot 10^{-10}$	$5.6 \cdot 10^{-10}$	$2.5 \cdot 10^{-10}$	$7.2 \cdot 10^{-10}$
$\sigma_{DC}(\Omega^{-1}\,cm^{-1})$	$6.1 \cdot 10^{-9}$	$7.6 \cdot 10^{-9}$	$3.6 \cdot 10^{-9}$	$1.3 \cdot 10^{-8}$	$7.7 \cdot 10^{-10}$	$5.7 \cdot 10^{-10}$

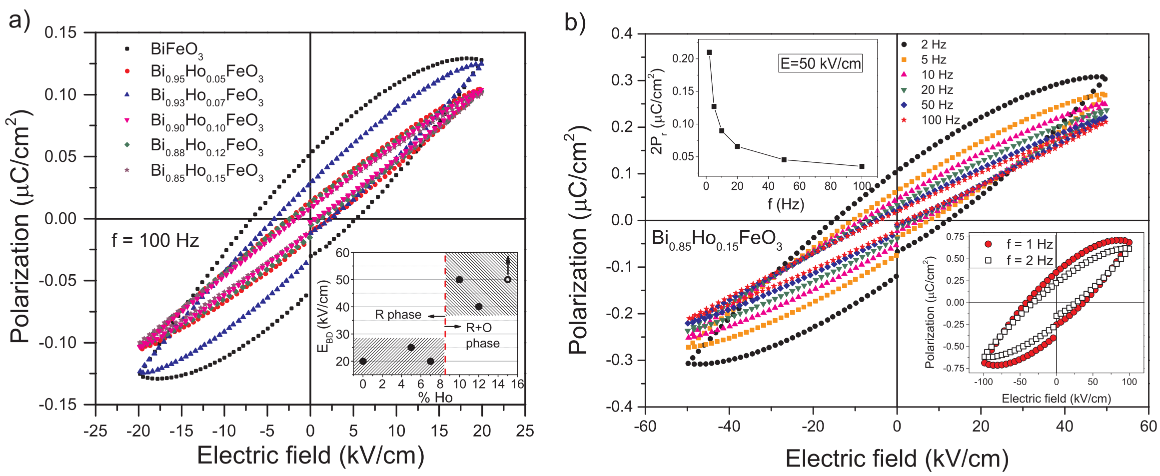

Fig. 5. a) Room-temperature P-E loops of $Bi_{1-x}Ho_xFeO_3$ samples. Inset presents breakdown fields for all samples except for BHFO15. b) P-E loops of BHFO15 sample taken at different frequencies. The frequency dependence of $2P_r$ is shown in the top-left corner inset, and the P-E loops in the field of large amplitude at low frequencies are shown in the bottom-right corner inset.

response and dc and ac conductivity contributions. It was shown that not only dc conductivity, but also grain boundary and interfacial effects were much reduced in biphasic $Bi_{1-x}Ho_xFeO_3$ ($x > 0.1$) samples. The dominant presence of orthorhombic phase in $Bi_{0.85}Ho_{0.15}FeO_3$ sample has stabilized the perovskite structure of BFO, significantly increased the breakdown field and improved BFO electrical performances. In high external electric fields (50 kV/cm and 100 kV/cm), P-E loops of $Bi_{0.85}Ho_{0.15}FeO_3$ sample manifested strong frequency dependence and abrupt increase of remnant polarization and coercive field at low frequencies. It was proposed that defect dipoles were oriented along the direction of spontaneous polarization, following the domain switching, and were therefore a primary cause of the enhanced polarization properties of $Bi_{0.85}Ho_{0.15}FeO_3$ sample. Although it is well established opinion that appearance of orthorhombic paraelectric phase degrades ferroelectricity of BFO, our study contributes to better understanding of polarization mechanisms in biphasic bismuth ferrite.

Acknowledgments

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Coherent manipulation of single electron spins with Landau-Zener sweeps

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We propose a method to manipulate the state of a single electron spin in a semiconductor quantum dot (QD). The manipulation is achieved by tunnel coupling a QD, labeled L, and occupied with an electron to an adjacent QD, labeled R, which is not occupied by an electron but having an energy linearly varying in time. We identify a parameter regime in which a complete population transfer between the spin eigenstates $|L\uparrow\rangle$ and $|L\downarrow\rangle$ is achieved without occupying the adjacent QD. This method is convenient due to the fact that manipulation can be done electrically, without precise knowledge of the spin resonance condition, and is robust against Zeeman level broadening caused by nuclear spins.

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Introduction. The initialization, manipulation, and readout of single electron spins in an efficient way are necessary for the implementation of single electron spin qubits [1]. Spin-orbit interactions and stray magnetic fields of micromagnets provide a necessary toolkit to control the single electron spin [2–7]. In electric dipole spin resonance (EDSR), microwaves drive an electron to oscillate in the spin-orbit field and/or the magnetic field gradient, producing a coherent spin rotation.

The Landau-Zener-Stückelberg-Majorana (LZSM) model [8–11] is one of the few analytically solvable time-dependent problems in quantum mechanics. It has found applications modeling nanoelectromechanical systems [12], optomechanical systems [13], Bose liquids [14], molecular magnets [15], Rydberg atoms [16], superconducting qubits [12,17–20], and semiconductor singlet-triplet qubits [21–23]. In the LZSM model the energy difference between two coupled states is varied linearly in time, while the coupling between the states is time independent. This results in a transition between the states with the probability determined by the coupling constant and the rate of the sweep.

Unlike the two-level LZSM problem, multilevel LZSM problems are not exactly analytically solvable for a general case [24–30]. Chirped Raman adiabatic passage (CHIRAP) [31,32,32–34] and similar techniques [35–41] allow for the efficient transfer of populations between two uncoupled levels. In order to utilize CHIRAP, the energy of the radiatively decaying state is varied linearly in time with laser pulses having chirped frequencies.

Equivalently to CHIRAP, the goal of our scheme is to transfer the population between two uncoupled levels $|L\uparrow\rangle$ and $|L\downarrow\rangle$ by coupling the levels of the L electrostatically defined quantum dot (QD) in a time-independent manner to an adjacent electrostatically defined quantum dot, whose energy is linearly varying in time [42]. It should be noted that, as the probability to occupy the adjacent quantum dot R remains negligible in this scheme, the states in the R QD can be extremely susceptible to relaxation without influencing the efficiency of our scheme. The scheme under study is also applicable to coupled donors [43] and coupled donor-dot systems [44].

We discuss two possible realizations of our scheme. In the first realization the R quantum dot has significantly larger Zeeman splitting than the L quantum dot. Then, the scheme operates even in the case when the rate of non-spin-conserving tunneling events is significantly smaller than the rate of spin-conserving events. This regime is often present in GaAs double quantum dots. In the second realization the Zeeman splittings of the left L and right R quantum dots are comparable in magnitude but the rates of spin-conserving and non-spin-conserving tunneling events must be comparable. This regime can be reached for electrons in InAs double quantum dots and holes in GaAs double quantum dots.

The Hamiltonian. We model a situation where the electron spin is localized in the L quantum dot. The energy of the R quantum dot is varied linearly in time (Fig. 1),

$$H(t) = \sum_{c}\sum_{\sigma} E_{c,\sigma}(t)|c\sigma\rangle\langle c\sigma| + \tau \sum_{\sigma}\sum_{c\neq\bar{c}} |c\sigma\rangle\langle\bar{c}\sigma| + \tau_{\Delta}\sum_{\sigma\neq\bar{\sigma}}\sum_{c\neq\bar{c}} |c\sigma\rangle\langle\bar{c}\bar{\sigma}|. \quad (1)$$

The sum over the charge states runs over the left and the right quantum dots, $c = L,R$, and the sum over spin states runs over spin-up and spin-down states $\sigma = \uparrow,\downarrow$. Furthermore, $E_{c\sigma}$ represents the energy with charge state c and spin state σ. The energies of the L quantum dot are time independent, $E_{L\uparrow} = \Delta E_L/2$, $E_{L\downarrow} = -\Delta E_L/2$, where ΔE_L is the Zeeman splitting in the left quantum dot. The energies of the R quantum dot are time dependent with a linear time dependence, $E_{R\uparrow} = \Delta E_R + \beta t$, and $E_{R\downarrow} = \beta t$, where ΔE_R is the Zeeman splitting in the right quantum dot, t is time, and β the Landau-Zener velocity (see Fig. 1).

The off-diagonal terms in the Hamiltonian are the spin-conserving tunneling amplitude τ, and the non-spin-conserving tunneling amplitude τ_{Δ}. The non-spin-conserving tunneling can appear due to spin-orbit interaction or be induced by the stray field of the micromagnet, which is inhomogeneous in the tunneling direction [45,46].

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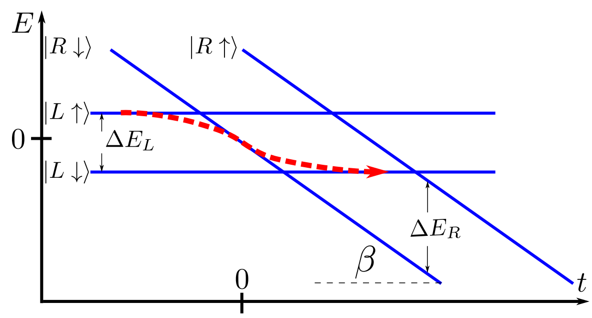

FIG. 1. The energy diagram. We initialize the electron in the $|L\uparrow\rangle$ state, with the R quantum dot being higher in energy. We ramp the energies of the states in R quantum dot with a Landau-Zener velocity β. In the figure, $\beta < 0$. The goal of our scheme is to find a parameter regime in which the adiabatic evolution path is followed (red dashed arrow). The Zeeman splittings of the L and R quantum dots are marked as ΔE_L and ΔE_R, respectively.

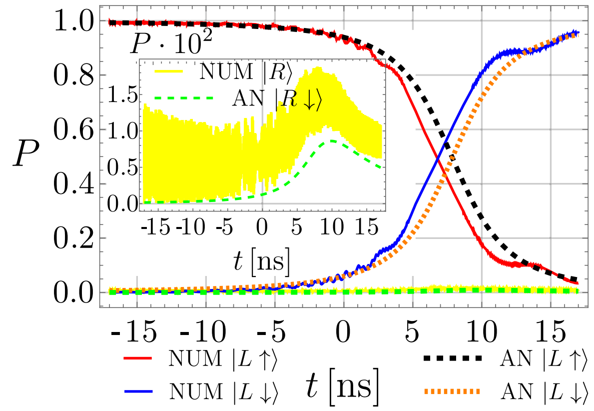

FIG. 2. The comparison between the numerically computed probabilities [obtained from evolving the state using the Hamiltonian of Eq. (1)] (Num) and analytic adiabatic three-level probabilities Eq. (2) (An). The parameters of the plot are the Landau-Zener velocity $\beta = 5 \times 10^3$ eV/s, the tunnel coupling $\tau = 6.5$ μeV, corresponding to an interdot separation of $l = 179$ nm (for more information, see the Supplemental Material [47]), the non-spin-conserving tunnel coupling $\tau_\Delta = 0.25\tau$, the external magnetic field Zeeman splitting in the left QD $\Delta E_L = 1$ μeV, and Zeeman splitting in the right quantum dot $\Delta E_R = 200\Delta E_L$. The inset represents the magnification of the occupation probabilities of the states in the R quantum dot.

Different Zeeman splittings. We initialize the system in the $|L\uparrow\rangle$ state, at a negative instance of time $-T/2$. If the product of the Landau-Zener velocity β and the total duration of the Landau-Zener sweep T is smaller than the Zeeman splitting of the right quantum dot $\Delta E_R > \beta T$, and if the R quantum dot is initially positively detuned with respect to the L quantum dot, our system behaves as an effective three-level system. Furthermore, if the evolution of the system is adiabatic ($\tau^2, \tau_\Delta^2 \gg \beta\hbar$), the system will remain in the instantaneous eigenstate of the Hamiltonian for the entire duration of the Landau-Zener sweep T. Given all these assumptions, we can calculate the adiabatic eigenvectors, and therefore the time evolution of our three state probabilities,

$$P_{L\uparrow} = \tau_\Delta^2 \frac{|\lambda(t) + \Delta E_L/2|^2}{N(t)^2}, \quad P_{L\downarrow} = \tau^2 \frac{|\lambda(t) - \Delta E_L/2|^2}{N(t)^2},$$
$$P_{R\downarrow} = \frac{\left|\lambda(t)^2 - \Delta E_L^2/4\right|^2}{N(t)^2}, \tag{2}$$

where $\lambda(t)$ is the appropriate adiabatic eigenvalue [see the Supplemental Material [47] for the expression for $\lambda(t)$] and $N(t)$ is the normalization of the adiabatic eigenvectors. For simplicity, we have omitted to explicitly state that $\lambda(t)$ is also a function of ΔE_L, β, τ, τ_Δ. Depending on the values of τ and τ_Δ, $\lambda(t) = 0$ close to $t = 0$ (for $\tau = \tau_\Delta$), $\lambda(t) = 0$ at $t > 0$ (for $\tau > \tau_\Delta$), and $\lambda(t) = 0$ at $t < 0$ (for $\tau < \tau_\Delta$). Furthermore, the adiabatic eigenvalue takes the following values, $\lambda(t = \mp\infty) = \pm\Delta E_L/2$, $-\Delta E_L/2 \leqslant \lambda(t) \leqslant \Delta E_L/2$, for every t. Therefore, the maximal possible occupation probabilities are $P_{L\uparrow}^{\max} \sim \tau_\Delta^2 \Delta E_L^2$, $P_{R\downarrow}^{\max} \sim \Delta E_L^4$, $P_{L\downarrow}^{\max} \sim \tau^2 \Delta E_L^2$. If $\tau, \tau_\Delta \gg \Delta E_L$, no significant population will occupy the R quantum dot, $P_R \approx 0$ at every instance of time (see Fig. 2), and a complete population transfer between the spin eigenstates $|L\uparrow\rangle$ and $|L\downarrow\rangle$ occurs.

In contrast to EDSR techniques, our scheme does not require precise knowledge of the spin resonance condition ΔE_L and operates without microwaves. However, in order for our scheme to be successful, a necessary requirement is that the quantum dots have significantly different Zeeman splittings $\Delta E_L \ll \Delta E_R$. For a typical double quantum dot system where the distance between the quantum dots is $\sim$200 nm, the required gradient would be $dB_z/dx \sim 10$ T/μm, which is for a factor of 10 larger than the currently maximally achieved experimental value [6,48]. A possible way to induce a large enough difference of Zeeman energies between quantum dots is to engineer the g factor of one of the quantum dots L to be almost zero, and engineer the g factor of the R QD to be significantly larger [49–52]. This could be achieved by locally inducing different content of Al in the GaAs mixture [50].

Equal Zeeman splittings. Again we initialize the system in the $|L\uparrow\rangle$ state, at a negative instance of time $-T/2$. Another way for our scheme to be successful is that the magnitude of spin-conserving and non-spin-conserving tunnelings are comparable, $\tau \approx \tau_\Delta$. The requirement for our scheme to work is $\tau/\tau_\Delta \sim 4l/3\Lambda_{SO} \approx 1$ can be fulfilled in InAs [53]. Here, l is the interdot separation and Λ_{SO} is the spin-orbit length, defined by [54,55] $\Lambda_{SO} = \hbar/m^*\sqrt{\cos\phi^2(\beta-\alpha)^2 + \sin\phi^2(\beta+\alpha)^2}$, for a two-dimensional electron gas (2DEG) in the (001) plane. Here, m^* is the effective electron mass, ϕ is the angle between the [110] crystallographic axis and the interdot connection axis, and β and α are Dresselhaus and Rashba spin-orbit constants, respectively. Possible ways of controlling the spin-orbit interaction is the variation of angle between the external magnetic field and the spin-orbit field [56], variation of the direction in which the double quantum dot (DQD) is grown [57] (and therefore maximizing $\cos\phi$), isotopic control of indium in InGaAs, or electric field control of the Rashba constant [58,59].

In the adiabatic limit ($\tau^2 = \tau_\Delta^2 \gg \beta\hbar$), the system will remain in the instantaneous eigenstate of the Hamiltonian for the entire duration of the Landau-Zener sweep T. In that limit, we can calculate the adiabatic eigenvectors, and therefore the

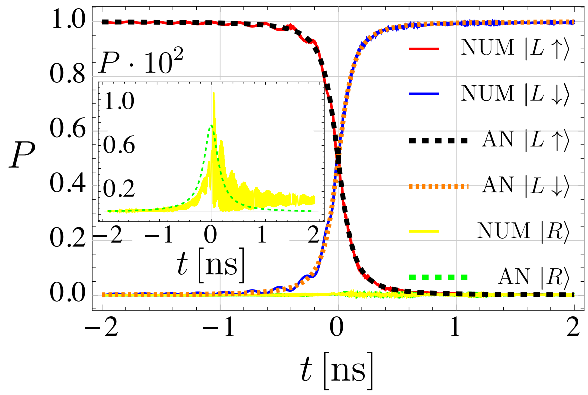

FIG. 3. Comparison between the numerically computed probabilities [obtained from evolving the state using the Hamiltonian of Eq. (1)] (Num) and analytic adiabatic four-level probabilities Eq. (3) (An). The inset represents the magnification of the probability to occupy the R quantum dot. The parameters of the plot are the Landau-Zener velocity $\beta = 4\times 10^6$ eV/s, the tunnel hopping $\tau = 50$ μeV, corresponding to interdot distance of $l = 280$ nm for $m^* = 0.023m_e$ (for more information, see the Supplemental Material [47]), the Zeeman energies $\Delta E_L = \Delta E_R = 17$ μeV.

time evolution of our four state probabilities,

$$P_{L\uparrow} = \tau^2\frac{|\Lambda(t)+\Delta E_L/2|^2}{\tilde{N}(t)^2},\quad P_{L\downarrow} = \tau^2\frac{|\Lambda(t)-\Delta E_L/2|^2}{\tilde{N}(t)^2},$$

$$P_{R\downarrow} = P_{R\uparrow} = \frac{\left|\Lambda(t)^2-\Delta E_L^2/4\right|^2}{2\tilde{N}(t)^2}, \tag{3}$$

where $\Lambda(t)$ is the corresponding adiabatic eigenvalue and $\tilde{N}(t)$ the wave-function normalization.

The requirement that spin-conserving and non-spin-conserving tunnel couplings are equal is due to the fact that when $\Delta E_L = \Delta E_R$, the adiabatic eigenfunctions have only a vanishing contribution of the two states of the R quantum dot when $\tau \approx \tau_\Delta$ is fulfilled. In the case of $\tau \gg \tau_\Delta$, the adiabatic eigenfunctions have only a small component in the $|R\downarrow\rangle$ state when $\Delta E_L \ll \tau,\tau_\Delta$, and the $|R\uparrow\rangle$ state is detuned during the duration of the Landau-Zener sweep T.

Similarly to the previous implementation of our scheme, the appropriate adiabatic eigenvalue spans between $\Lambda(t=\mp\infty) = \pm\Delta E_L/2, -\Delta E_L/2 \leqslant \Lambda(t) \leqslant \Delta E_L/2$, for every t, with $\Lambda(t)=0$ for $t\approx 0$. The maximal possible occupations of states for the case $\Delta E_L = \Delta E_R$ are $P_{L\uparrow}^{\max} \sim \tau^2\Delta E_L^2$, $P_{L\downarrow}^{\max} \sim \tau^2\Delta E_L^2$, and $P_{R\uparrow}^{\max} = P_{R\downarrow}^{\max} \sim \Delta E_L^4/2$. Equivalently to CHIRAP, the probabilities to occupy the $|R\downarrow\rangle$ and $|R\uparrow\rangle$ states are negligible at all instances of time $P_R \approx 0$ in the case when $\tau \gg \Delta E_L$ (see Fig. 3), and a complete population transfer between the spin eigenstates $|L\uparrow\rangle$ and $|L\downarrow\rangle$ occurs.

Experimental realizations. Our control scheme works optimally when the Zeeman splitting of the L QD is small. Furthermore, different signs of the Landau-Zener velocity and initial detunings need to be used for different initial spin states. We will address the problem of initializing and measuring electron spin states when the Zeeman splitting in the L QD is small in the remaining part of this section.

If the thermal broadening of the lead is smaller than the Zeeman splitting of the electron spin states $k_BT_e \ll \Delta E_L$, the state of the spin qubit can be initialized by tuning the chemical potential of a nearby lead close to the $|\Downarrow\rangle$ state of the spin qubit. When lead-to-dot relaxation occurs, the only possible state to which the electron can relax from the lead is the $|\Downarrow\rangle$ state. Furthermore, single-shot measurement of the electron spin state can be achieved in a similar manner [60], by tuning the chemical potential of the lead in such a way so that only one of the states can tunnel out of the quantum dot to the lead.

As our scheme operates optimally in low magnetic fields $k_BT_e > \Delta E_L$, the initialization and readout, validating the efficiency of our scheme, must be done in an alternative way, via the R QD. The chemical potential of the lead coupled to the R QD can be tuned between the spin states of the R QD. After successful initialization of the $|R\downarrow\rangle$ state, the spin is shuttled to the $|L\downarrow\rangle$ state, followed by a manipulation of the spin according to our scheme.

After the manipulation stage, the modification in the current of a quantum point contact (QPC) near R is monitored. If the current of the QPC is unchanged, this means that the manipulation stage did not produce any leakage to the R quantum dot and that the spin measurement stage can follow. In the spin measurement stage, states $|L\downarrow\rangle$ and $|R\downarrow\rangle$ are aligned in energy one more time. If the electron spin was in the $|L\downarrow\rangle$ state, a tunneling event occurs and a nearby QPC modifies its current accordingly [61,62]. On the other hand, if the electron spin was in the $|L\uparrow\rangle$ state, the current of the QPC would remain unchanged.

In the case of $\Delta E_L = \Delta E_R$ (and therefore $\tau \approx \tau_\Delta$) and when $\Delta E_L < k_BT_e$, the initialization could still be achieved by waiting a sufficiently long time for the electron spin to relax to the thermal equilibrium state. However, spin readout would need to be done with alternative methods, because both spin eigenstates are energetically allowed to tunnel to the R QD when $|L\downarrow\rangle$ and $|R\downarrow\rangle$ are aligned in energy. This is why we consider the case $\Delta E_L \ll \Delta E_R$ to be more likely to implement in future experiments, and only consider the influence of nuclear spin noise for this realization.

Errors due to nuclear spins. We model the influence of nuclear spins as a distribution of the magnetic field in the L and R quantum dot, centered around the external magnetic field in the left and the right dot $\Delta E_L,\Delta E_R$, with standard deviations $\sigma = g_L\mu_BB_N$, $\chi = g_R\mu_BB_N$, where $g_{L(R)}$ is the electron g factor in the left (right) quantum dot, μ_B is the Bohr magneton, and B_N is the root mean square of the distribution of the nuclear magnetic field [63]. The influence of nuclear spins on our manipulation scheme can be estimated by averaging the probabilities of all relevant states over a distribution of nuclear spins,

$$\bar{P}_{c\sigma} = \iint_{-\infty}^{\infty}\frac{P_{c\sigma}}{2\pi\chi\sigma}e^{-\frac{(\Delta E-\Delta E_L)^2+(\tilde{\beta}\tilde{t}-\beta t)^2}{4\sigma^2\chi^2}}d(\Delta E)d(\tilde{\beta}\tilde{t}), \tag{4}$$

where $c = L,R$, $\sigma = \uparrow,\downarrow$, with the exclusion of the detuned $|R\uparrow\rangle$ state.

In Fig. 4 we show how the nuclear spins influence our control scheme in the case of no uncertainty of the magnetic field in the right quantum dot, $\chi = 0$. If the random nuclear field is parallel with the external magnetic field, this gives rise

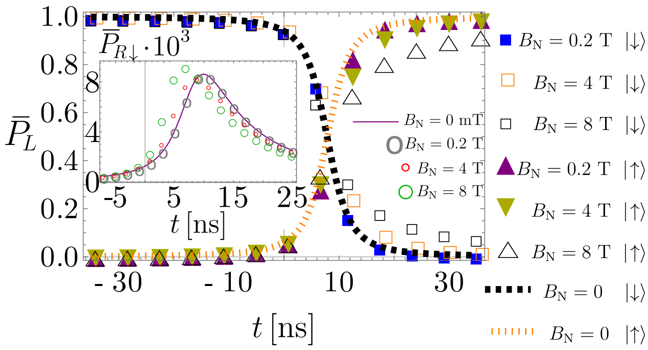

FIG. 4. Spin manipulation in the presence of nuclear spins. The parameters of the plot are the Landau-Zener velocity $\beta = 5 \times 10^3$ eV/s, the tunnel coupling $\tau = 6.5\ \mu$eV, corresponding to an interdot separation of $l = 179$ nm (for more information, see the Supplemental Material [47]), the non-spin-conserving tunnel coupling $\tau_\Delta = 0.25\tau$, the Zeeman energy in the left quantum dot $\Delta E_L = 1\ \mu$eV, the standard deviation in the right quantum dot $\chi = 0$, and the g factor in the left quantum dot $g_L = 1.2 \times 10^{-3}$. The inset represents occupation of the states in the R quantum dot.

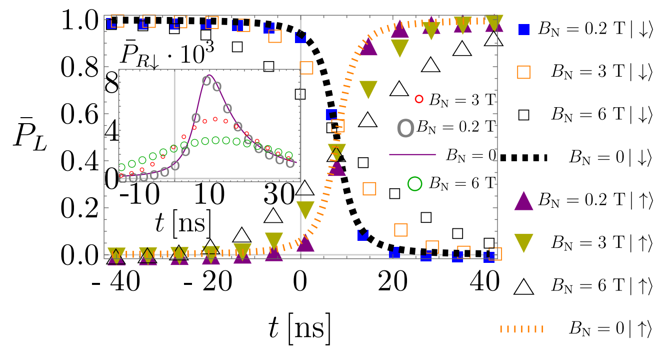

FIG. 5. Spin manipulation in the presence of nuclear spins. The parameters of the plot are the Landau-Zener velocity $\beta = 5 \times 10^3$ eV/s, the tunnel coupling $\tau = 6.5\ \mu$eV, corresponding to an interdot separation of $l = 179$ nm (for more information, see the Supplemental Material [47]), the non-spin-conserving tunnel coupling $\tau_\Delta = 0.25\tau$, the Zeeman splitting in the left quantum dot $\Delta E_L = 1\ \mu$eV, the g factor in the left quantum dot $g_L = 1.2 \times 10^{-3}$, and the g factor in the right quantum dot $g_R = 200 g_L$. The inset represents occupation of the states in the R quantum dot.

to more leakage into the $|R\downarrow\rangle$ state. However, if the random nuclear field is antiparallel with the external magnetic field, this gives rise to less leakage into the $|R\downarrow\rangle$ state, and these two effects (less and more leakage to $|R\rangle$) cancel first order in ΔE_L.

In Fig. 5 we present the behavior of our control scheme under an influence of random nuclear spins in both quantum dots. Other than the already mentioned mechanism of additional leakage, the uncertainties in the nuclear field in the right quantum dot (and therefore the position of the level $|R\downarrow\rangle$) lead to reduced maximal probability to occupy the $|R\downarrow\rangle$ state (Fig. 5, inset, dark gray versus green circles). In contrast to EDSR, we are able to achieve a full transfer of population between the spin eigenstates, even when the uncertainty in the energy difference between spin eigenstates is large (Fig. 5, black open squares and triangles).

An effective nuclear magnetic field of unknown intensity in the z direction is going to change the instance of time in which the energy of the state $|R\downarrow\rangle$ is located between the energies of the states $|L\uparrow\rangle$ and $|L\downarrow\rangle$. For a nuclear magnetic field parallel with the external field, the energy of the state $|R\downarrow\rangle$ is located between the energy of the states $|L\uparrow\rangle$ and $|L\downarrow\rangle$ at a time $t < 0$. In contrast to that, for a nuclear magnetic field antiparallel with the external field, the energy of the state $|R\downarrow\rangle$ is located between the energies of the states $|L\uparrow\rangle$ and $|L\downarrow\rangle$ at a time $t > 0$. A process such as this is described with a Gaussian distribution, centered around βt with a standard deviation $\chi = g_R \mu_B B_N$, where g_R is the g factor in the right quantum dot, $g_R \gg g_L$. This leads to a reduced maximal value of the occupation of the $|R\downarrow\rangle$ state, without changing the averaged occupation of the $|R\downarrow\rangle$ per unit time $\bar{\bar{P}}_{R\downarrow}(T) = \int_{-T/2}^{T/2} \bar{P}_{R\downarrow}(t)dt/T =$ const for a large enough T. Since the nuclear spins do not affect the final probabilities, our scheme can be operated in the presence of nuclear spin induced decoherence, as long as the total sweep time (in our case $\sim$80 ns) is shorter than the characteristic time of nuclear spin evolution (1 μs) [63]. It should be noted that quasistatic detuning noise yields the same effect as having an uncertain nuclear spin distribution in the R quantum dot, and therefore we do not address this issue separately in this Rapid Communication.

Conclusions and final remarks. To conclude, we have proposed a method to manipulate a single electron spin by using Landau-Zener sweeps. Our control method is robust against the uncertainties of the nuclear field and static charge noise, and operates without microwaves and without precise knowledge of the spin resonance condition.

Note added. In the process of preparing this Rapid Communication, we became aware of an article [42] implementing similar ideas for double quantum dot $S - T_+$ qubits.

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PAPER

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Field-dependent superradiant quantum phase transition of molecular magnets in microwave cavities

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Abstract

We study a superradiant quantum phase transition in the model of triangular molecular magnets coupled to the electric component of a microwave cavity field. The transition occurs when the coupling strength exceeds a critical value, d_c, which, in sharp contrast to the standard two-level emitters, can be tuned by an external magnetic field. In addition to emitted radiation, the molecules develop an in-plane electric dipole moment at the transition. We estimate that the transition can be detected in state-of-the-art microwave cavities if their electric field couples to a crystal containing a sufficient number of oriented molecules.

Keywords: molecular magnets, quantum optics, quantum computing

(Some figures may appear in colour only in the online journal)

1. Introduction

The superradiant phase of a collection of emitters coupled to common electromagnetic field mode is characterized by a finite number of photons in the ground state of the combined system. In the model of two-level emitters coupled to a single cavity mode [1–4], the superradiant phase appears when the emitter-field coupling g exceeds some critical value g_c [5, 6]. Theoretical and experimental search for the superradiant phase transition has included atoms and molecules coupled to single- and multimode optical cavities, Josephson junction qubits in microwave resonators, as well as ultracold atoms in optical traps [7–11].

According to the no-go theorem [12–14], the ground state of any collection of two-level emitters with dipolar coupling to a mode of electromagnetic field does not contain cavity photons. This result seems to render the superradiant quantum phase transition impossible, and it was extended to the case of many electromagnetic field modes and many levels in Josephson junctions [13, 14]. However, the superradiant phase transition was predicted to occur in the interacting emitters as well as in an ensemble of inhomogeneously coupled emitters and many modes [7, 15]. It was indeed observed in ultracold gases [9]. Here, we consider emission from an ensemble of interacting spins, and we are not aware of any extension of the no-go theorem that applies to our case.

Two-level emitters interacting with the quantized electromagnetic field of resonant cavity are described by the standard Dicke, Jaynes–Cummings, and Tavis–Cummings models of quantum optics [2]. Motivated by the spin-electric coupling of molecular magnets [16], we introduce a new model for the emitter in a cavity. The emitter degree of freedom represents the chirality of ground-state spin texture in a triangular molecular magnet, which interacts with the molecule's total spin. A crystal with oriented molecular

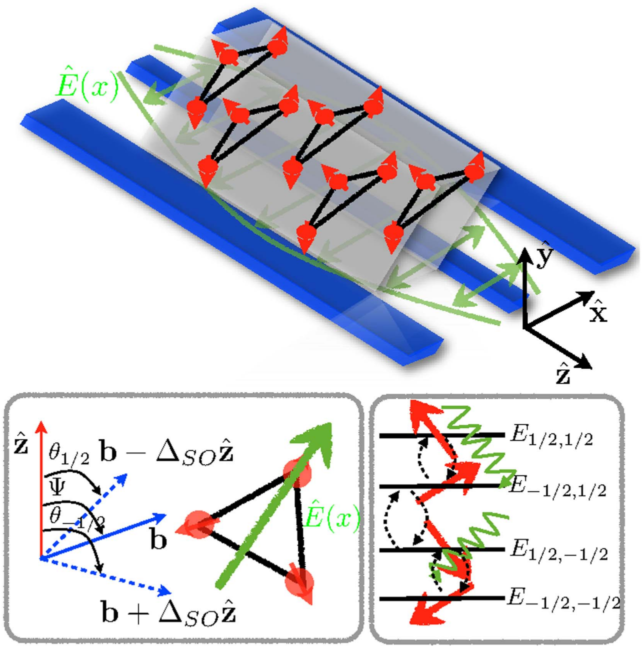

Figure 1. Geometry of a crystal of molecular magnets in a microwave cavity and external magnetic field. Electric field of the cavity mode is in the plane of the molecule (x–y), as shown on the top panel. External magnetic field $\mathbf{B}$ produces the effective fields $\mathbf{b} = g_{\mathrm{mol}}\mu_{\mathrm{B}}\mathbf{B}$, which is tilted by the angle ψ from the normal $\mathbf{e}_z$ to the plane of the molecules, and lies in the z–x plane. The fields $\tilde{\mathbf{b}}(\pm 1/2)$ form angles $\theta_{\pm 1/2}$ with the z-axis, and define quantization axes of spin, as shown on the bottom left panel and described in the main text. On the bottom right panels, the effective quantization axes of the states with energies $E_{\mathrm{C}_z,\mathrm{S}_z}$ are illustrated by arrows. The cavity field induces transitions between the states of equal spins and different chiralities, represented by the wavy lines. The angle $\delta = \theta_{-1/2} - \theta_{1/2}$ determines the coupling strength of different transitions.

magnets in a strip-line cavity is then described by a generalization of the Dicke model, see figure 1.

Molecular magnets are molecules with strong exchange interaction and pronounced spin anisotropy in the low-energy sector. At low energies they can be described as a set of interacting spins localized at positions of magnetic centers. The strong anisotropy governs the relaxation from spin-ordered states so that the transitions occur through quantum tunneling of magnetization over the anisotropy-induced barrier. In antiferromagnetic triangular molecules, the low energy states are two doublets of total spin $S = 1/2$, distinguished by the chirality of their spin textures $C_z = \pm 1/2$. Symmetry analysis then leads to the prediction that the transitions between the states of same spin and different chiralities are induced by external electric fields in the molecule's plane. This transition suggests that the spin order in these molecules can be manipulated by an external electric fields.

We find that the cavity and molecular magnets can be driven through the transition by modifying the direction or intensity of the external magnetic field. The critical coupling for the transition is magnetic field dependent, due to the interaction between the spins within the molecules. Spin interaction makes the ground- and low-energy excited states coherent superpositions of entangled total spin and chirality of the spin texture. In molecular magnets [17], the quantum coherence was crucial for explaining the dynamics of magnetization: transitions between the spin states are coherent processes, and show the interference between transition paths [18–20] and the Berry phase [21–23]. The superradiant phase transition would therefore provide a way to study the spin coherence in the single-molecule magnets. In addition, observation of the magnetically controllable transition would prove the existence of spin-electric interaction.

Superradiance, the relaxation of an ensemble of emitters at a rate proportional to the square of their number, is another manifestation of coherent coupling of emitters to the quantized cavity field. It was predicted to occur in the molecular magnets, but the experimental results so far remain inconclusive [24–30]. As opposed to superradiance, the superradiant phase is a ground state property of the coupled emitter-cavity system. Therefore, the detection of the superradiant phase requires measurement of the static properties of the coupled emitter-cavity system, and not the following of the dynamics of relaxation from the excited state.

Control of our predicted superradiant phase transition is specific for the model of triangular spin-1/2 antiferromagnetic molecular magnets, since it depend on the form of spin-electric coupling. In addition to the specific form, the transition requires the interaction of sufficient strength. Experiments on molecular magnets, like charged Fe{4} clusters [31], and Mn ions in piezoelectric crystals [32] do show coupling of spins to electric fields. In these cases the electric fields modify the spin anisotropy. This interaction may allow for a similar analysis of electrically driven superradiant phase transition, once the details of the spin-electric interaction are known.

2. Model

At low energy, triangular molecular antiferromagents are characterized by the total spin, $\mathbf{S} = \sum_{i=1}^{3} \mathbf{s}_i$, where i counts the spins-1/2 on magnetic centers, and pseudospin-1/2 chirality $\mathbf{C}$, associated with the spin texture, see figure 1. The components of the chirality are defined in terms of spin operators as

$$C_x = -\frac{1}{3}(\mathbf{s}_1 \cdot \mathbf{s}_2 - 2\mathbf{s}_2 \cdot \mathbf{s}_3 + \mathbf{s}_3 \cdot \mathbf{s}_1), \tag{1}$$

$$C_y = \frac{1}{3}(\mathbf{s}_1 \cdot \mathbf{s}_2 - \mathbf{s}_3 \cdot \mathbf{s}_1), \tag{2}$$

$$C_z = \frac{1}{8\sqrt{2}}\mathbf{s}_1 \cdot (\mathbf{s}_2 \times \mathbf{s}_3). \tag{3}$$

The components C_x and C_y are two-spin operators that, in analogy with the Pauli spin operators, flip the chirality C_z, which is a three-spin operator [16]. The operators $\mathbf{S}$ and $\mathbf{C}$ are independent and satisfy spin commutation relations: $[S_i, S_j] = i\epsilon_{ijk}S_k$, $[C_i, C_j] = i\epsilon_{ijk}C_k$, and $[S_i, C_j] = 0$, where i, j, and k count the Cartesian components of spin and chirality [16, 33]. Strong antiferromagnetic exchange between the molecular spins constrains the total spin of the molecule to $S = 1/2$. This model is valid at the temperatures below the gap to excited $S = 3/2$ states, typically of the order of 10 K in spin triangles [34].

The two degrees of freedom, **S** and **C**, couple differently to external fields: while the spin couples to the magnetic field via Zeeman term, the chirality couples to $\mathbf{E}_{\|}$, the components of external electric field in the plane of the triangular molecule [16]. The Hamiltonian of the molecular magnet in external electric and magnetic fields is [16]

$$H_{\rm mol} = 2\Delta_{\rm SO} C_z S_z + \mathbf{b}\cdot\mathbf{S} + d_0 \mathbf{E}_{\|}\cdot\mathbf{C}. \quad (4)$$

The Bohr magneton, $\mu_{\rm B}$, and the molecular gyromagnetic ratio, $g_{\rm mol}$, are absorbed in the effective magnetic field $\mathbf{b} = g_{\rm mol}\mu_{\rm B}\mathbf{B}$, and we set $\hbar = 1$. The zero-field splitting, $\Delta_{\rm SO}$, caused by the spin–orbit interaction and with a typical strength $\Delta_{\rm SO}/(g\mu_{\rm B}) \sim 1$ T, produces an Ising coupling between S_z and C_z, with the spin z axis normal to the molecule's plane [17, 34]. The chirality interacts with the in-plane components of the electric field and, through the Ising coupling, with **S**, the total spin [16, 33]. The selection rules for electrically driven transitions in equation (4) are set by the $D_{3\rm h}$ symmetry of the molecule, and read $\Delta C_z = \pm 1$. Therefore, it is possible to access the transitions that would be forbidden by the selection rules $\Delta S_z = \pm 1$ which are valid for the magnetic driving [33].

A crystal of N emitters interacting with a mode of the resonant cavity is described by

$$H = H_{\rm cav} + \sum_j H_{0,j} + \sum_j V_j, \quad (5)$$

where $H_{\rm cav} = \omega a^\dagger a$ describes the cavity photon, and each $H_{0,j} = 2\Delta_{\rm SO} C_{j,z} S_{j,z} + \mathbf{b}\cdot\mathbf{S}_j$ describes a molecule interacting with an external classical magnetic field **B**. The interaction terms

$$V_{\rm j} = d(a + a^\dagger) C_{j,x}, \quad (6)$$

are couplings of molecules to the electric component of quantized cavity field. The operator a ($a^\dagger$) annihilates (creates) a cavity photon. The coupling constant $d = d_0 E_x$ includes both the intrinsic single-molecule spin-electric coupling d_0 and the in-plane electric field amplitude E_x. The molecules in a crystal lie in parallel planes, so that their spin quantization axes all point in the same direction [35] that we label z, see figure 1. Any variation of molecular orientations, e.g., due to crystal defects, is equivalent to a change in the effective coupling between the molecular spins and the cavity photons. We assume that the Zeeman coupling of **S** to the magnetic component of the cavity field is weak, as in the microwave cavities with molecules placed near the maximum of the electric field amplitude [36], and do not include it in equation (5).

The non-interacting Hamiltonian, $H_0 = H_{\rm cav} + \sum_j H_{0,j}$, conserves the number of photons $\hat{n} = a^\dagger a$, as well as the z-components of chiralities, $C_{j,z}$. Within each simultaneous eigenspace of $\hat{n}$ and $C_{j,z}$ it reduces to a spin Hamiltonian

$$H_{0,j;n,c} = n\omega + \mathbf{b}\cdot\mathbf{S}_j + 2c\Delta_{\rm SO} S_{j,z}, \quad (7)$$

where n and c are the respective eigenvalues of the operators $\hat{n}$ and $C_{j,z}$. This reduced Hamiltonian is readily diagonalized, and we find the energies

$$E_{n,c,s} = s|\tilde{\mathbf{b}}(c)| + n\omega \quad (8)$$

and the eigenstates

$$|n, c, s\rangle = |n, c\rangle \otimes |\mathbf{S}\cdot\mathbf{e}_c = s\rangle. \quad (9)$$

The effective magnetic fields are $\tilde{\mathbf{b}}(c) = \mathbf{b} + 2c\Delta_{\rm SO}\mathbf{e}_z$, with $c = \pm 1/2$, and $s = \pm 1/2$ denotes the molecule's spin projection along $\mathbf{e}_c$, the direction of effective field $\tilde{\mathbf{b}}(c)$. Explicitly, the molecule's eigenstates in the $C_{j,z}$, $S_{j,z}$ basis are given by the unitary transformation $|n, c, s\rangle = |n\rangle \otimes U|c, s_z\rangle$, where $U = \sum_{c=\pm 1/2} P_c \exp(-i\,\theta_c S_y) P_c$ maps the state $|c, s_z\rangle$ of the molecule with chirality c and spin projection s_z to the z-axis into a state with the same chirality and the spin projection $s = s_z$ along the rotated spin axis (see figure 1). The angles $\theta_{\pm 1/2}$ are

$$\theta_c = \arccos\frac{2c\Delta_{\rm SO} + b\cos\psi}{\sqrt{b^2\sin^2\psi + (2c\Delta_{\rm SO} + b\cos\psi)^2}} \quad (10)$$

with ψ and b denoting the polar angle and intensity of the field **b**. The operators $P_c = 2\,c\,C_z + 1/2$ are projectors to the states of a given chirality c.

3. Rotating wave approximation (RWA)

As opposed to the standard Jaynes–Cummings model in quantum optics [37], the RWA for a single-molecule magnet in a cavity cannot be obtained by simply neglecting the terms proportional to $C_+ a^\dagger$ and $C_- a$, since the chirality interacts with the spin, which in addition couples to an external magnetic field.

To derive the RWA of equation (5) we switch to the interaction picture, $V_j(t) = {\rm e}^{iH_0 t} V_j {\rm e}^{-iH_0 t}$, with respect to the terms $H_0 = \sum_j H_{0,j}$ that do not involve the interaction of the molecule with the cavity electric field. Using the known eigenvalues and eigenstates of H_0, we find

$$V_j(t) = \frac{d}{2}\sum_{n,c,s,s'} {\rm e}^{i(E_{n,c,s} - E_{n,-c,s'})t} M(c, s, s') \times |n, c, s\rangle\langle n, -c, s'|({\rm e}^{i\omega t} a^\dagger + {\rm e}^{-i\omega t} a\,), \quad (11)$$

where $M(c, s, s') = \langle \mathbf{S}_j\cdot\mathbf{e}_c = s|\mathbf{S}_j\cdot\mathbf{e}_{-c} = s'\rangle$ is the scalar product of the spins with projections s and s' on the axes $\mathbf{e}_c$ and $\mathbf{e}_{-c}$. Explicitly, $M(c, s, s) = \cos(\delta/2)$, $M(\pm 1/2, s, -s) = \mp i\sin(\delta/2)$, $\delta = \theta_{-1/2} - \theta_{1/2}$, and the angles $\theta_{\pm 1/2}$ are given in equation (10).

The RWA consists of neglecting the terms in the interaction-picture Hamiltonian, equation (11), that oscillate with frequencies close to molecular transitions $\omega_{ij} \sim |E_i - E_j|$, and keeping the terms that oscillate slowly, with frequencies close to the detuning between the transition and the cavity mode. In this case the fast-oscillating terms average out to zero, and we can neglect them. The resonant frequencies in our model are $\omega_{\rm r}^{\pm} = (|\tilde{\mathbf{b}}(1/2)| \pm |\tilde{\mathbf{b}}(-1/2)|)/2$. We have set the direction of z axis so that $|\tilde{\mathbf{b}}(1/2)| \geqslant |\tilde{\mathbf{b}}(-1/2)|$.

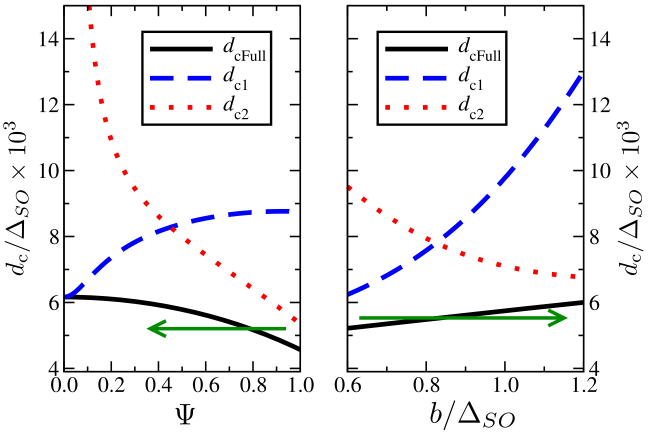

Figure 2. The critical couplings in the full RWA (d_{cFull}), in standard RWAs near ω_r^+ (d_{c1}), and near ω_r^- (d_{c2}), as a function of angle with respect to the normal to molecule's plane ψ, and the intensity b of the external magnetic field $\mathbf{b}$, respectively. Variations in either ψ or b lead the system through the superradiant quantum phase transition (motion along the arrows switches from $d > d_c$ to $d < d_c$). For this figure, the number of molecules is $N = 10^5$, and the cavity frequency is the mean of the two resonant frequencies $\omega = (\omega_r^+ + \omega_r^-)/2$ (see text). On the first panel $b = 0.9\Delta_{SO}$, and on the second $\psi = 0.6$ rad.

The condition for the validity of the RWA is that the molecule-cavity coupling constant d is much smaller than the resonant frequencies, $d \ll \omega_r^\pm$. In addition, the RWA can reproduce the standard model of a two-level emitter when the cavity frequency is tuned close to one of the transitions and far from the other, e.g., $|\omega - \omega^+| \gg |\omega - \omega^-|$. This tuning is possible only when

$$|\omega_r^+ - \omega_r^-| \gg d. \tag{12}$$

The condition in equation (12) can not be satisfied when $\mathbf{b} \approx \Delta_{SO}\mathbf{e}_z$, i.e., when the magnetic field axis is near the normal to the molecule, and the magnetic field intensity is comparable to spin-orbit splitting Δ_{SO}. We will focus on the case when both resonances have to be taken into account, either due to the deliberate tuning of the cavity frequency, or due to violation of equation (12). In this case, the amplitudes of the resonant transitions vary strongly with the magnetic field, and we will see that this leads to new effects. When equation (12) is satisfied, the cavity can be tuned so that the RWA leads to the Tavis–Cummings model [3, 4], and consequently to the familiar superradiant phase transition and a single transition resonant with the cavity, see figure 2. We will label the critical couplings in approximations that keep a single transitions as $d_{c1}(d_{c2})$.

After the removal of the counter-rotating terms and switching back to the Schrödinger picture, the molecule-cavity interaction is

$$V_{\rm RWA} = d\sum_j (a + a^\dagger)\left(\frac{\cos\delta}{2}C_{j,x} - \sin\delta\, S_{j,y}C_{j,y}\right) + i(a - a^\dagger)\left(\sin\theta_{-\frac{1}{2}}S_{j,x} + \cos\theta_{-\frac{1}{2}}S_{j,z}\right)C_{j,y}. \tag{13}$$

The final Hamiltonian in RWA is $H_{\rm RWA} = H_0 + V_{\rm RWA}$, and it is analogous to the Tavis–Cummings model of two-level atoms in a resonant cavity. Similarly to the conservation of the number of excitations in the Tavis–Cummings model, $H_{\rm RWA}$ conserves the quantity

$$N_{\rm exc} = \hat{n} + \sum_j (1 + \tilde{S}_{j,z} + 2C_{j,z}\tilde{S}_{j,z}), \tag{14}$$

where $\tilde{\mathbf{S}}_j = U\mathbf{S}_j U^\dagger$, with U defined above equation (10). We interpret $N_{\rm exc}$ as the conserved number of excitations by counting molecules in the state $|c, s\rangle = |1/2, -1/2\rangle$ as zero excitations, molecules in the states $|-1/2, \pm 1/2\rangle$ as one excitation, molecules in the state $|1/2, 1/2\rangle$ as two excitations, and each cavity photon as one excitation. We choose an additive constant so that $N_{\rm exc} = 0$ corresponds to all the molecules in the state $|1/2, -1/2\rangle$ and no photons in the cavity.

4. Superradiant quantum phase transition

We study the superradiant phase transition in the rotating wave and mean-field approximations. This amounts to substituting photon annihilation(creation) operator $a(a^\dagger)$ by their expectation value $\langle a\rangle(\langle a\rangle^*)$ in $H_{\rm RWA}$, thus neglecting any quantum fluctuations. This approximation is valid for large photon numbers, $n \gg 1$. The mean-field energy, $E_{\rm MF}(\langle a\rangle)$ is the ground state energy of

$$H_{\rm RWA}^{\rm MF}(\langle a\rangle) = \omega|\langle a\rangle|^2 + \sum_j H_{0,j} + V_{\rm RWA}(\langle a\rangle). \tag{15}$$

We find that $E_{\rm MF}(\langle a\rangle)$ is independent of the phase of $\langle a\rangle$, which we set to be real in further discussion. The mean-field value of the annihilation operator, $\langle a\rangle_{\rm MF}$ is, by the self-consistency condition, the value of $\langle a\rangle$ for which $E_{\rm MF}(\langle a\rangle)$ is at a minimum. Similarly, the mean field state of the molecules is the ground state of $H_{\rm RWA}^{\rm MF}(\langle a\rangle_{\rm MF})$. Without RWA, the phase of $\langle a\rangle_{\rm MF}$ is set by the minimization requirement so that the quantity is real [38].

When the cavity is decoupled from the molecules, $d = 0$, the system is in the normal state, and $\langle a\rangle_{\rm MF} = 0$. The superradiant phase transition means the appearance of $\langle a\rangle_{\rm MF} > 0$ for coupling strength larger than the critical value, $d > d_c$. We analytically determine the critical coupling d_c from the properties of $E_{\rm MF}(\langle a\rangle)$. In the absence of photons, $E_{\rm MF}(0)$ is a finite ground state energy of N molecules in the ground state. For large photon numbers, the energy is dominated by the free photon term, and therefore diverges, $\lim_{\langle a\rangle\to\infty} E_{\rm MF} = \infty$. Furthermore, since $E_{\rm MF}(\langle a\rangle)$ explicitly depends only on the square of its argument, $\partial_{\langle a\rangle}E_{\rm MF}|_{\langle a\rangle=0} = 0$. We determine the critical coupling as the smallest value of d for which $\partial^2_{\langle a\rangle}E_{\rm MF}(\langle a\rangle)|_{\langle a\rangle=0} < 0$. Together with the limiting values and the zero derivative at zero, this condition guarantees the existence of a minimum for the mean-field energy that is lower than $E_{\rm MF}(0)$ at some finite value of $\langle a\rangle$.

The procedure of minimization applied to $H_{\rm RWA}^{\rm MF}$, equation (15), and using the RWA potential with both

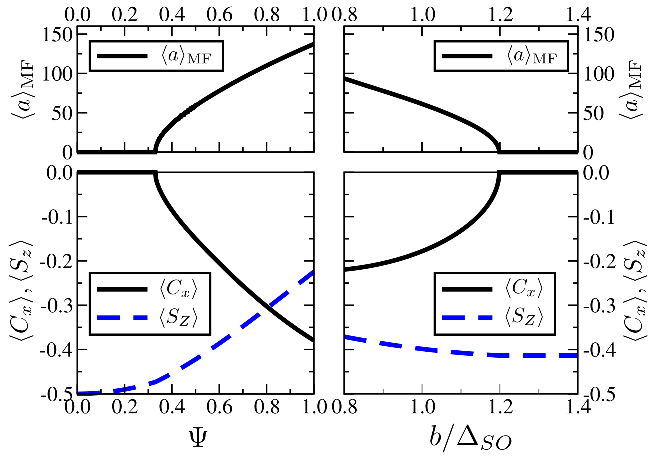

Figure 3. Response of molecules and cavity field to the changes in direction ψ (first panel) and intensity b (second panel) of the external magnetic field **b**. At the superradiant transition, the mean-field value of the photon annihilation operator $\langle a\rangle_{\rm MF}$ becomes nonzero (upper panels). At the same value of **b**, an in-plane electric polarization $\propto\langle C_x\rangle$ appears, signaling the superradiant phase. The magnetization normal to the molecule's plane $\propto\langle S_z\rangle$ shows a more rapid change with **b** then in the normal state. System parameters are the same as in figure 2, and $d = 6 \times 10^{-3}\Delta_{\rm SO}$.

resonances, equation (13) gives the critical coupling

$$d_{\rm cFull} = \sqrt{\frac{8\omega\Delta_{\rm SO}b}{N\left[\tilde{b}\left(\frac{1}{2}\right) + \tilde{b}\left(-\frac{1}{2}\right)\cos\delta\right]}}. \qquad (16)$$

This **b**-dependent $d_{\rm cFull}$ is one of our main results, figure 2. The dependence is due to both the modification of the energy levels of H_0, and to modification of the coupling constants for transitions through spin-overlap terms in equation (13). The result, equation (16) clearly can not be explained by the usual RWA at either of the resonant frequencies, as illustrated in figure 2. The value of $\langle a\rangle_{\rm MF}$ grows as $\langle a\rangle_{\rm MF} \propto \sqrt{d - d_{\rm c}}$ for $d > d_{\rm c}$, and $\langle a\rangle_{\rm MF} \propto \sqrt{N}$. We note that the mean-field approximation can be applied to the Hamiltonian equation (5) without the RWA, predicting the superradiant phase transition with the critical coupling scaled by a factor of 2 form the value in equation (16). The dependence of $d_{\rm c}$ on **b** allows for a controllable superradiant phase transition. Changes in $d_{\rm c}$, given by equation (16), can lead the system into or out of the superradiant phase, see figure 2. The measurement of the escaping radiation as done, for example, by using input–output theory [39], would then serve as a signature of superradiant state [9, 40–42]. Turning the tables, identifying the superradiant phase transition would allow to extract the value of the spin-electric coupling constant.

The quantum properties of escaping light can not be determined in the mean-field theory, since we assume that the radiation is in a specific classical state described by the expectation value $\langle a\rangle_{\rm MF}$. However, in the superradiant phase of the Dicke model, the emitted radiation is nonclassical in the sense that is cannot be described by a positive-definite probability distribution function [43]. We expect that there are quantum correlations of emitted light from our system, but their evaluation is beyond the scope of this work.

In addition to the nonzero photon occupation of the cavity mode, see figure 3, the transition is characterized by a change in the expectation value of the chirality. For $d < d_{\rm c}$, the molecules are in the state with $C_{j,z} = -1/2$, with zero expectation values of $C_{j,x(y)}$. After the transition, for $d > d_{\rm c}$, the in-plane components of chirality have nonzero expectation value, i.e., $\langle C_{j,x}\rangle \neq 0$ in our model. The fact that only the x-components gets a finite expectation value comes from our phase convention for $\langle a\rangle$, and the form of the interaction with the electric fields [38]. The molecules develop electric dipole moments for $d > d_{\rm c}$, and the transition can be detected by the electric response, for example by measuring the spin-electric susceptibility [33], as well as by the emitted radiation, lower panels of figure 3.

5. Experimental requirements

The detection of the controllable superradiant phase transition is possible in an experiment that would monitor the escaping radiation or the electric response of the molecular magnets coupled to a cavity, as they are driven through the transition by a change in external magnetic field. The transition occurs when $d_0E_x > d_{\rm c}$, see equation (16), and the controllable transition can be achieved for large electric field amplitude E_x and strong molecular spin-electric coupling d_0. The critical coupling strength diminishes with the increasing number of molecules, $d_{\rm c} \propto N^{-1/2}$. Other parameters that influence $d_{\rm c}$ are the strength of the magnetic field required for control and the cavity frequency. Both are set by the zero-field splitting of the molecular magnet, $\Delta_{\rm SO} \approx g\mu_{\rm B}{\rm B} \approx \hbar\omega$. The typical value of zero-field splitting in triangular molecular antiferromagnets [34, 44] is $\Delta_{\rm SO} \sim 1\ {\rm K}\cdot k_{\rm B}$. Therefore, the relevant resonant frequencies lie in the microwave range, $f = \omega/(2\pi) \sim 15$ GHz, and the external magnetic fields needed for control are $B \sim 1$ T.

We take the estimate for the value of the molecular spin-electric coupling constant, $d_0 \sim 10^{-4}|eR_0|$, where R_0 is the distance between the magnetic centers in the molecule from the *ab-initio* work [45, 46]. The corresponding numerical value of the dipole moment is $d_0 \sim 10^{-32}$ Cm. Assuming the electric field amplitude $E_x = \sqrt{\hbar\omega/c_1V}$, where c_1 is the resonator capacitance per unit length, and V is the mode volume, we estimate that $E_x \sim 100$ V/m is achievable in narrow strip-line cavities [47], giving $d = d_0E_x \sim 10^{-11}$ eV. Under these conditions, the controllable superradiant phase transition will occur if the crystal coupled to the cavity electric field contains $N > N_{\rm c} \sim 10^{15}$ molecular magnets. Spin ensembles of comparable effective volume were coupled to microwaves by placing them on top of the resonators [48–50].

Coupling such a large number of molecules to a resonant cavity requires very dense crystals, with the intermolecular distances about 20 times shorter than typical 1 nm, i.e., the critical density $n_{\rm c}$ is four orders of magnitude too large. There are two molecular parameters that can be manipulated to relax this requirement, the zero-field splitting, Δ_{SO}, and the intrinsic spin-electric coupling strength of a single molecule, d_0. Estimating the cavity electric field from a single photon energy in the mode volume implies $E_x \propto \sqrt{\omega}$. Taking into account that the control magnetic field, b, the effective fields, $\tilde{b}(\pm 1/2)$, and the resonant frequency, ω, all scale with Δ_{SO}, equation (16) implies

$$n_c \propto \frac{\Delta_{SO}}{d_0^2}. \quad (17)$$

Triangular molecular magnets come in great variety, and the chemical alteration of their composition gives access to many spin Hamiltonians at low energies. The zero field splitting can be as low as $\Delta_{SO} \approx 3 \times 10^{-2}$ K, and potentially even lower [51], with the values in V_{15}, Fe_8, and Cu_3 complexes in the range 10^{-2} – 1 K [35, 51–55]. Modification of the intrinsic spin-electric coupling, d_0, can reduce the critical density even more. Since $n_c \propto d_0^{-2}$, and increase in d_0 does not affect any other experimental parameter, searching for the molecules with large d_0 may be the right way to achieve the proposed controllable superradiant phase transition in a laboratory. An increase in d_0 by a factor of 100 from the numerically predicted value [45, 46] would bring the critical density to the value of 1 nm^{-3}.

The magnetic field dependent critical coupling, equation (16), is found in the model that assumes an ideal cavity, zero temperature, and validity of the mean-field approach. The constraints for the realistic experiments are less stringent. The superradiant phase appears in the system's ground state which is predominantly occupied at temperatures lower than the first molecule's excitation, $T \ll \Delta_{SO}/k_B \sim 1$ K. The time scale of relaxation to the superradiant ground state is given by the spin relaxation time of the molecular magnet, which can be as long as a microsecond [44]. This time should be longer than the Rabi time of the collective coupling between the molecules and the field mode, i.e. there should be many Rabi oscillations before the spins relax. For $N > N_c$, this requirement is satisfied due to scaling of the Rabi frequency. In addition, the cavity decay time should be longer than the spin decay time, which would require the cavity Q-factor of the order $Q \sim 10^5$–10^6 for long spin coherence times of $\tau_s \sim 1\ \mu$s, and less stringent $Q \sim 10^3$–10^4 for $\tau_s \sim 10$ ns. In superconducting stripline cavities, the external magnetic field of the order of 1 T would reduce the Q-factor, unless the field lies in the plane of the strips. There is a geometry that allows for the variation of the angle ψ between the magnetic field $\mathbf{b}$ and the normal to triangles while keeping $\mathbf{b}$ in the plane of the superconductors. In this geometry, the triangles should lie in the plane normal to the axis of the strips. Further enhancement of Q-factor is possible by resonator engineering [56].

As a matter of principle, it is not necessary to use the stripline cavities, and any microwave resonator with large regions of significant electric field and sufficient Q-factor can support the superradiant phase transition. Manipulation of the electric field amplitude of the cavity mode and choosing a shape that can accommodate many molecules can be an efficient way to reach the required coupling strength, since $N_c \propto E_x^{-2}$. Therefore, 3D cavities can also be used.

The disorder in the molecule's energies due to imperfections of the crystal may bring some of the molecules out of resonance and reduce the effective N below the total number of molecules. However, the superradiant effect also suppresses such inhomogeneous broadening [57–59]. When the collective coupling of many emitters exceeds the bandwidth of their ensemble, the broadening vanishes altogether so that even far off-resonant molecules interact strongly with the field mode. This allows one to increase the number of active emitters in the cavity in realistic devices.

6. Conclusions

We have introduced a model of a crystal of single-molecule triangular antiferromagnets interacting with an external classical homogeneous magnetic field and the electric component of a quantized cavity field. The model shows a superradiant quantum phase transition with the critical coupling tunable by applied magnetic field. The strong coupling regime is characterized by nonzero mean photon number and electric dipole moment in the triangle plane. With state-of-the-art cavities and current estimates of spin-electric coupling strength, the tunable transition is achievable for 10^{15} molecules coupled to the cavity. This value can be reduced by choosing the molecules with weak zero-field splitting Δ_{SO} and strong intrinsic spin-electric coupling d_0. Observation of the predicted transition and its magnetic field dependence can serve as a probe of spin-electric interaction. While our models describes triangular single-molecule magnets, it can be extended in order to study of other emitters described by entangled discrete degrees of freedom.

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PAPER

Variation of electric properties across the grain boundaries in $BiFeO_3$ film

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Variation of electric properties across the grain boundaries in $BiFeO_3$ film

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Abstract

Stark differences in charge transport properties between the interior and the boundary regions of grains in an undoped $BiFeO_3$ thin film have been found. The material is ferroelectric and each grain is a single domain. A spatial resolution that distinguishes between the grain interior and the boundary between the grains has been achieved by using piezoelectric force microscopy and conductive atomic force microscopy measurements. The local electric properties, as well as the local band gap show hysteresis only when probed in the grain interior, but do not show hysteresis when probed in the region around the boundary between two grains. The leakage current is more pronounced at the grain boundaries, and the region that carries significant current increases with the applied voltage.

Keywords: multiferroics, thin films, electrical properties, grain boundaries, scanning probe microscopy

S Online supplementary data available from stacks.iop.org/JPhysD/49/045309/mmedia

(Some figures may appear in colour only in the online journal)

1. Introduction

Multiferroic materials exhibit at least two ferroic properties among magnetic, electric, and elastic responses. Simultaneous presence of at least two hysteretic responses and interaction between the associated orders has spurred interest in the mechanisms that govern the phase transitions in multiferroics [1–3]. The explanation of the multiferroic order remains an interesting open problem of condensed matter physics. A pair of ferroic properties causes nonlinear and nonstandard responses, e.g. a material will produce electric polarization when exposed to an external magnetic field. Such responses make the multiferroics interesting from a practical point of view by allowing for novel forms of control. The most sought-after applications of multiferroics are electrically controlled magnetic memories [4], and emerging spintronic devices based on the simultaneous use of electric polarization, based on the orbital order, and magnetization, based on the spin order [2, 5].

The properties of multiferroic materials structured at the nanoscale can be drastically different from the corresponding properties of the bulk. Integration of materials into current semiconductor technology requires fabrication and structuring of thin films, leading to the interest in variation of the material properties with the nanoscale structure, as well as to the development of methods for their synthesis [6, 7]. In addition to reduced dimension, the thin films often show granular structure on the characteristic length scale of the order of 10 nm. Details of the grain structure contribute to the variation of the properties of both the material and the devices.

One of the most well-known multiferroic materials is the bismuth ferrite ($BiFeO_3$). It shows high critical temperatures, both for the ferroelectric ordering below 1104 K [8] and the antiferromagnetic ordering below 643 K [9]. The interest in $BiFeO_3$ stems from the possibility of having all the technologically desirable properties of multiferroics at and above the room temperature. A major obstacle for the applications of $BiFeO_3$ is the existence of relatively large leakage currents which severely limit the electric fields that a material can sustain. The leakage currents have been explained by the existence of charge defects, for example the oxygen and bismuth vacancies [10]. Attempts at minimizing the leakage currents in $BiFeO_3$ thin films drive the interest in their electronic transport properties and their modification either by doping [11–14] or by modifying the conditions of film growth [15, 16].

The properties of multiferroic $BiFeO_3$ granular thin film strongly depend on the grain size. The Neel temperature was shown to correlate with the volume of the grains which affects the polar displacements of cations and changes in polarization [17]. The mechanical properties also depend on the grain size [18]. Therefore, the regions in proximity to the grain boundaries may play an important role in determining the material properties.

We have studied a film of an undoped, single crystallographic phase, $BiFeO_3$. The film has been produced by sol–gel spin coating. The film has shown granular structure, and we have probed the variation of the electronic properties on the spatial scale commensurate with the grain size. Our film did not have any holes and all the measured grains lied on the top of the film, and not on the substrate. The variation at probed length scale are therefore properties of the grain morphology and independent of the thickness or large-scale roughness of the film.

In our measurements, the local electric properties of the film have varied on two characteristic length scales, corresponding to the sizes of grains and boundary regions. In scanning probe measurements, we have found mild variations between the interiors of different grains when probing their band structure. On the other hand, the differences between the grain interiors and the grain boundaries have been drastic. We have measured the local electric properties of the $BiFeO_3$ film across the grain boundary, and have found that the boundary regions differ from the grain interior in the density of states, charge transport mechanism, and the absence of hysteresis in the I–V curves. Remarkably, all the measured properties have shown a hysteresis when measured in the grain interior, but there were no sings of hysteresis when probed at the boundary.

2. Experimental procedure

$BiFeO_3$ thin film was prepared via the sol–gel spin coating method. The details of preparation are presented in the supplementary material (stacks.iop.org/JPhysD/49/045309/mmedia).

Structural characterization was carried out using x-ray diffraction (XRD) with Cu–Kα radiation on a Rigaku Ultima IV diffractometer ($2\theta = 20°–60°$). Raman spectroscopy was used to study the vibrational properties of $BiFeO_3$ thin film. Micro-Raman spectra were collected using a Jobin Yvon T64000 spectrometer with a liquid-nitrogen-cooled CCD camera.

The morphology and phenomena at short length scales were recorded by atomic force microscopy (AFM). AFM imaging was performed using tapping mode on NT-MDT system Ntegra Prima and silicon NSG01 probes with the tip curvature radius of 6 nm. The phase lag of the cantilever oscillation was recorded simultaneously with the topography image.

We have investigated the electromechanical response of our sample by piezoresponse force microscopy (PFM). During PFM measurements, an AC bias with the amplitude of 10 V and frequency of 150 kHz has been applied between the tip and the substrate on which the $BiFeO_3$ film is grown. PFM measurements were done using TiN coated NSG01 probes with a tip curvature radius of 35 nm, a typical force constant of 5.1 N $m^{-1}$and typical resonant frequency of 150 kHz. The conductive tip was scanning the surface of the sample in contact mode while AC bias was applied to the tip. The AC bias was inducing the contraction and expansion of the sample, and these changes of the shape were monitored by the tip deflection. This local piezoelectricity of $BiFeO_3$ thin film was recorded in out-of-plane and in-plane polarization.

The local electrical conductivity of a $BiFeO_3$ film was probed by conductive atomic force microscopy (C-AFM). During C-AFM measurements, a DC bias voltage (from +2 to +6 volts) was applied between the tip and the substrate. Surface topography and current maps were obtained simultaneously by using a conducting probe in contact with the sample. The measurements were performed with the DCP20 probe of a nominal curvature radius of 50–70 nm and typical force constant of 48 N m^{-1}. In the same mode, the electrical measurements of current-voltage (I–V) characteristics were recorded in the bias voltage range from -10 V to $+10$ V. The I–V curves were measured using C-AFM at the points within the grain interior and at the points on the grain boundary. We have determined the band gap value of BiFeO3 film according to the same procedure as in references [20–22]. Thus, we have measured the local density of states and the local band gap in $BiFeO_3$ film using C-AFM. At each point we have repeated the measurements a few times, and therefore proved the reproducibility. Differential conductance spectra were obtained by averaging and differentiating five current-voltage curves measured on an individual grain of $BiFeO_3$ film. All AFM measurements were performed at ambient conditions (room temperature and air atmosphere).

3. Results and discussion

The crystallographic phase and structure of our sample have been determined by XRD. The XRD pattern of the $BiFeO_3$ thin film is shown in figure 1(a). The XRD peaks of $BiFeO_3$ film with a rhombohedrally distorted $BiFeO_3$ perovskite structure, belonging to the R3c space group have been indexed. No peaks originating from the secondary phase were observed. The absence of the impurity phase signal from XRD measurement does not imply that the sample itself is ultra pure. However, it does imply that there are no regions of impurity phase of appreciable size. From the Williamson–Hall plot [19], we have estimated the grain size in our film to ~38 nm and the microstrain to ~0.3%, as shown in figure 1(b). The diffraction peaks corresponding to the perovskite structure have been clearly observed. Figure 1(c) shows the histogram of the grain size distribution from the AFM measurement of the $BiFeO_3$ film. Raman spectrum of $BiFeO_3$ film has confirmed the rhombohedrally distorted structure without the presence

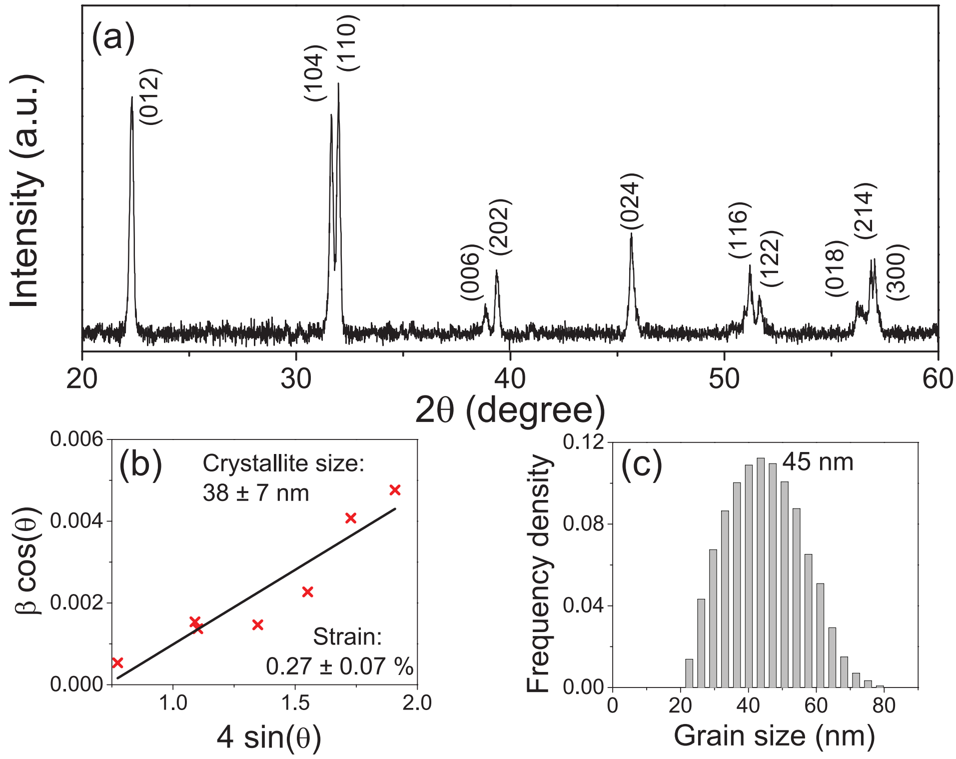

Figure 1. (a) X-ray diffraction pattern of the $BiFeO_3$ film fabricated by the sol–gel method, (b) Williamson–Hall plot for $BiFeO_3$ film with calculated crystallite size and strain, and (c) histogram of grain size distribution of $BiFeO_3$ film obtained from AFM image (see supplementary material (stacks.iop.org/JPhysD/49/045309/mmedia)).

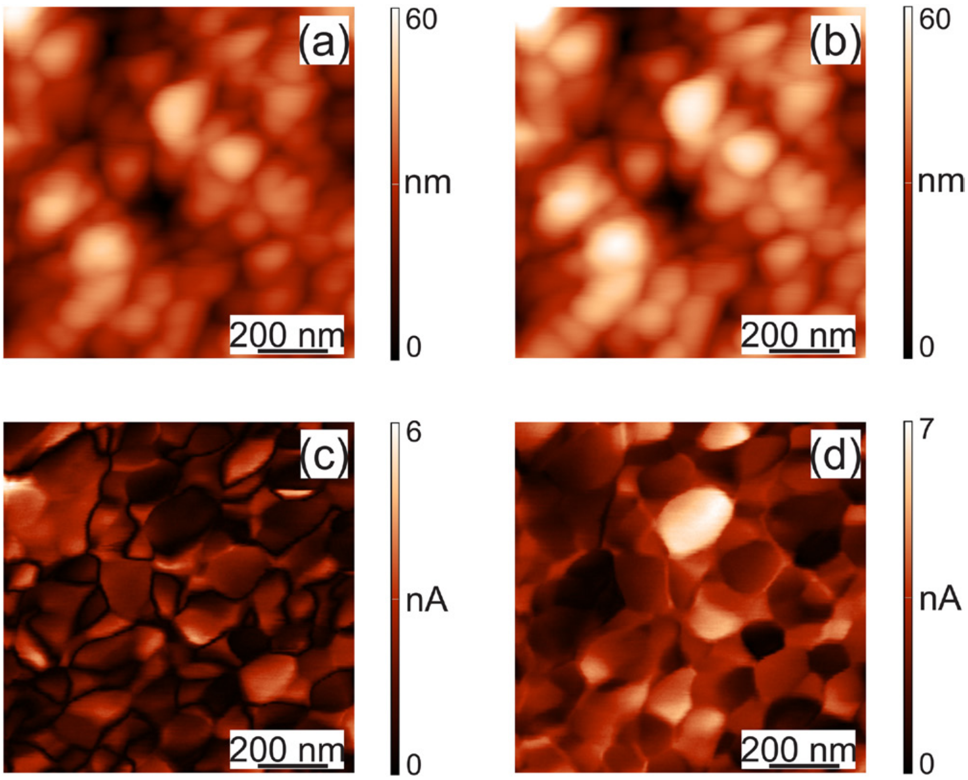

Figure 2. Topography (a) and out-of-plane PFM magnitude (c), topography (b) and in-plane PFM magnitude (d), showing the polarization components of $BiFeO_3$ film. The grains, visible on the topography images (a) and (b), correspond to the ferroelectric domain captured by the PFM magnitudes in (c) and (d).

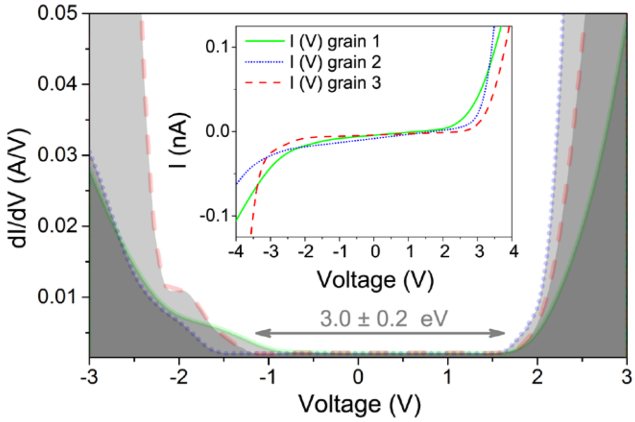

Figure 3. Representative differential conductance spectra measured on interior points of three different grains on $BiFeO_3$ film. Arrow shows the averaged band gap value. The corresponding I–V curves are shown in the inset in a wider voltage range, from −4 to 4 V.

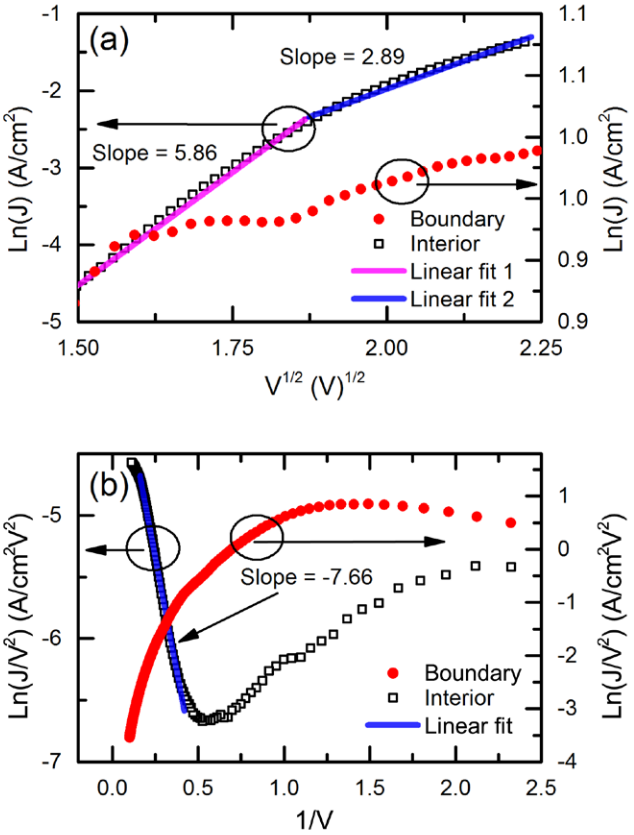

Figure 4. (a) Schottky thermionic emission plot, $\ln(J)$ versus $V^{1/2}$ and (b) Fowler–Nordheim plot, $\ln(J/V^2)$ versus $1/V$ at positive bias curves of the grain interior (left scale) and grain boundary (right scale) of the $BiFeO_3$ film.

of secondary phase. Raman scattering spectrum of the $BiFeO_3$ film is presented in supplementary material (stacks.iop.org/JPhysD/49/045309/mmedia).

Ferroelectric domains occur when the minimization of the electrostatic and elastic energy favors an inhomogeneous distribution in a material with unsaturated bulk electric polarization. The domain shapes and sizes are governed by various stresses that appear in the process of thin film growth [23, 24]. The granular structure of the $BiFeO_3$ film is dictated by lattice, morphology and thermal expansion coefficient mismatch between the $BiFeO_3$ film and the substrate [25, 26], the film thickness, and the temperature [27]. We have measured the polarization domains in the film, and found that they change on the characteristic length scale of ~40 nm. We have measured both the out-of-plane and the in-plane polarization, based on normal and lateral deflection of the AFM cantilevers during PFM measurements (figures 2(c) and (d)). Therefore, we have identified both the in-plane and out-of-plane polarization components. Comparison with the sample topography, figures 2(a) and (b), has shown that the domain boundaries coincide with the grain boundaries. Therefore, each grain in the film has been a single-domain particle. This kind of the domain distribution is characteristic for the small grains, while larger grains generically show a multi-domain structure [24]. In our film, we could not identify any multi-domain grains.

Knowledge of the charge transport mechanism is essential in the design of memory devices based on $BiFeO_3$ film. The granular film contains rough surfaces that cause an inhomogeneous behavior of conductivity [28]. We have investigated the spatial distribution of the density of states and of the band gap. We have achieved high resolution by measuring the I–V characteristics locally using C-AFM, and by extracting the corresponding differential conductances.

Figure 3 shows the characteristic spectra of local differential conductance as a function of voltage. The measurements have been performed on interior points of different grains, far away from any boundaries with the neighboring grains. The density of states has varied slightly between the grains. The estimated band gap is $E_g = 3.0 \pm 0.2$ eV, in agreement with the optical measurements [29–31]. Conduction at negative bias voltages corresponds to the states in the valence band, while the conduction at the positive bias corresponds to the states in the conduction band. The flat plateau around zero voltage represents the band gap. These results show that the grain interiors are very similar, even though the grain's immediate surroundings vary. Therefore, we claim that the properties at the length scale of the grain size are not influenced by the distant regions of the film, and therefore should not depend on the film thickness, as long as it is larger than the grain dimension.

We have observed a difference between the grain boundary and the grain interior in the local measurements of the current as a function of bias voltage. In the resulting I–V curves the conduction has been higher at the boundary. Conduction through semiconductor heterostructures is well researched, and various transport mechanisms have been proposed and observed [32, 33]. In our case, the distribution of electric polarization (see figure 2), and the typical gap sizes (see figure 3), suggest that the interior of the grain behaves as a semiconductor of fairly large band gap, ~ 3 eV. In the grain interior, the transport has been consistent with the tunneling through a barrier, either via Schottky or Fowler–Nordheim mechanism [32–34]. We have fitted the I–V curves in the spatial region of the grain interior, and in the voltage region $V > 2$ V, to the predictions of the tunneling transport theory. Up to $V \approx 5$ V, the Schottky mechanism of thermal excitations across the barrier explains the observed behavior. At larger voltages,

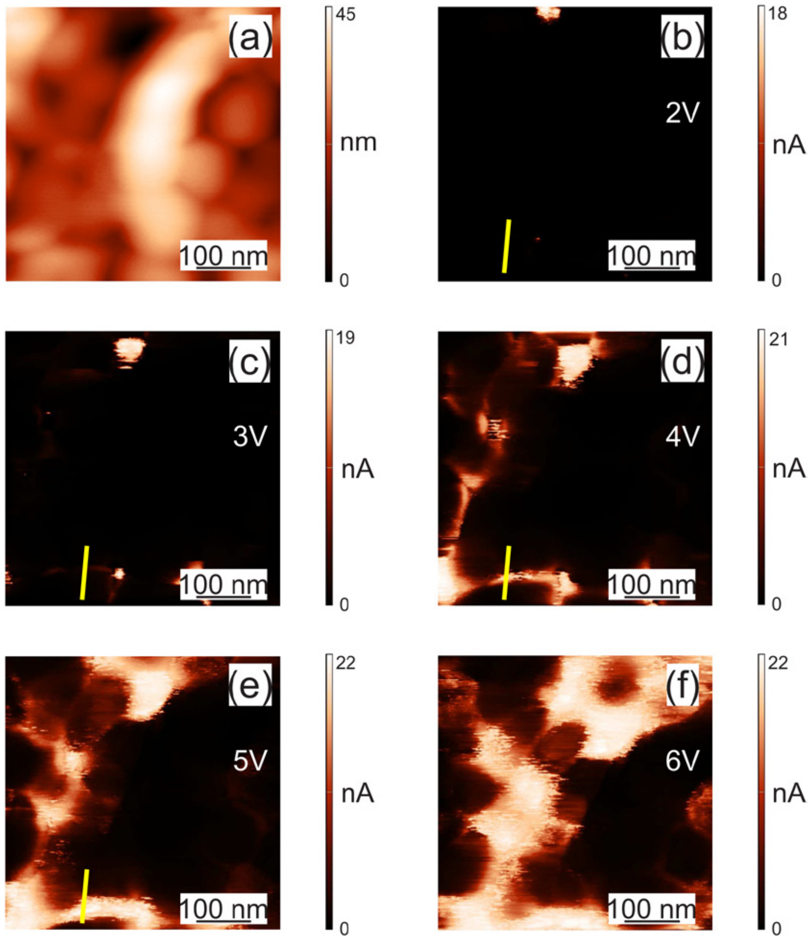

Figure 5. (a) Topography and ((b)–(f)) current maps (C-AFM images) according to bias voltages $V = 2, 3, 4, 5, 6$ V respectively. Bright regions means higher current. Notice the enhanced conductivity at grain boundaries and no conductivity regions in the grains interior. Bright line indicates the places between two grains where we have measured the current as a function of the position (shown in figure 6).

the results are consistent with the Fowler–Nordheim mechanism. Figure 4(a) shows the plot of $\ln(J)$ versus $V^{1/2}$ measured at various points in the $BiFeO_3$ film in the voltage range from 2 to 5 V. For the leakage current governed by the tunneling, $\ln(J/V^2)$ versus $1/V$ plot shows linearity for bias voltage well bellow the gap, i.e. $V < 2$ V (figure 4(b)), as we have observed in our film. At low fields, $V < 1.5$ V the grain interior has shown a plain Ohmic behavior (see supplementary material (stacks.iop.org/JPhysD/49/045309/mmedia)). As opposed to the grain interior, I–V curves of the grain boundary have not followed any standard transport model.

The local current distributions and the I–V characteristic of the $BiFeO_3$ film have been studied by the C-AFM. Current maps (C-AFM images) and topography images have been probed in the same spatial region of the sample. In C-AFM images, figure 5, the bright parts are conducting regions, while the dark regions are non-conducting. From the morphological and PFM measurements we have found that the $BiFeO_3$ film is inhomogeneous. A difference in electric transport properties between the grain interior and its boundary can appear for several reasons. Due to the different crystal orientation of the grains and the possible strain between the grains, the polarizations of neighboring grains are not equal and generically point in different directions. Furthermore, different polarizations

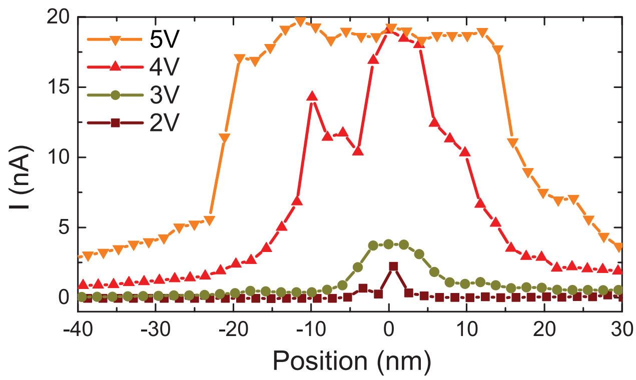

Figure 6. The current profiles of cross-sectional analysis along the bright solid line in figure 5.

of the neighboring grains cause strong electric fields in the region of the boundary between the grains. A similar phenomenon was observed in $HoMnO_3$ [35].

Our measurements have demonstrated that the local conduction pathways of the $BiFeO_3$ film coincide with the grain boundaries, while the interior of the grains remain insulating [36], as indicated in figure 5, and consistent with the measurements on the interior points of various grains, presented in figure 3. The charge transport of $BiFeO_3$ film has been

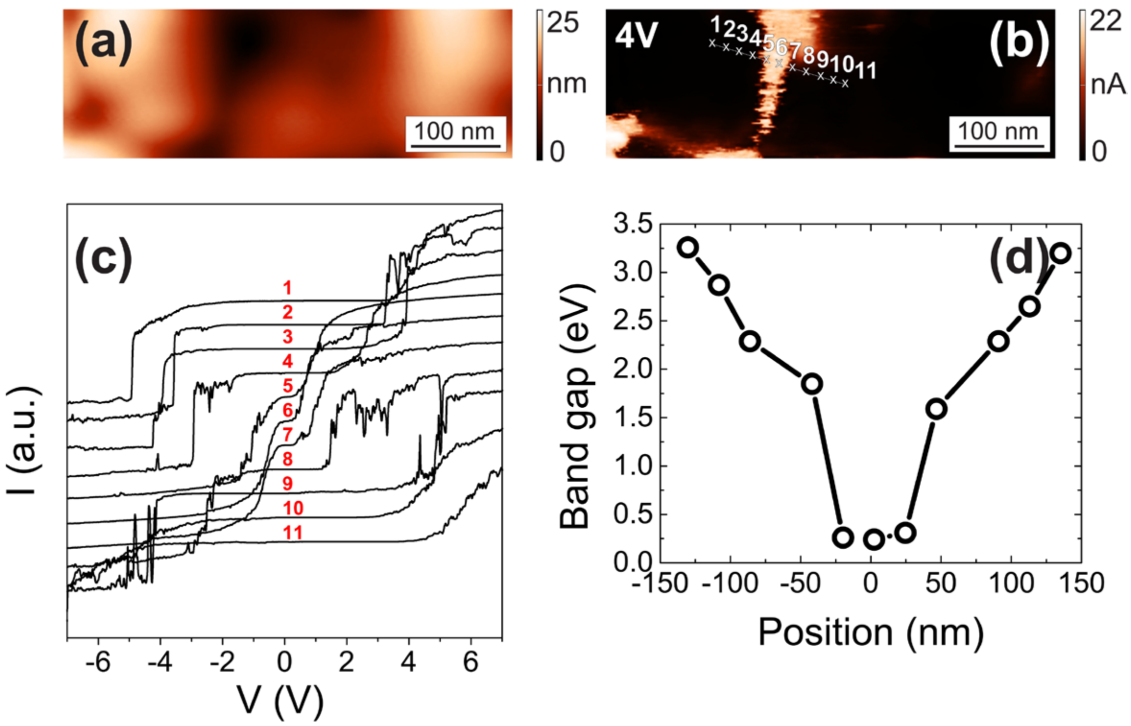

Figure 7. (a) Topography, (b) C-AFM image with line across the grain boundary, (c) I–V characteristics for 11-points across grain boundary and (d) behavior of the band gap as a function of the position of the grain boundary.

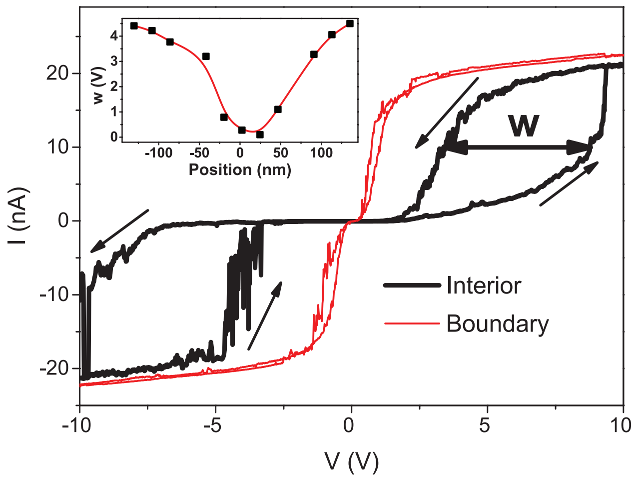

Figure 8. Dramatic I–V hysteresis in the grain interior (heavy line) and the absence of the hysteresis in the grain boundaries (thin line) of the $BiFeO_3$ film. In the inset, the width of the hysteresis curve (w) is shown as a function of the position across the grain boundary. Solid line in the inset is a guide to the eye.

investigated at different applied bias voltages, both slightly smaller and larger than the band gap. Topography image (figure 5(a)) and the corresponding C-AFM images at bias voltage ranged from 2 to 6 V (figures 5(b)–(f)) have confirmed high correlation between the granular structure of the film and the shape of the conduction pathways. Under low bias voltages, narrow charge transport pathways form (figures 5(b) and (c)) at the places that are low in the topographic image of the film, and are barely visible. As the bias voltage increases, both the width of the conduction pathways and the intensity of the current that flows through them increases.

The evolution of the conduction pathways with the increasing bias voltage is shown in figure 6. The current through the film has been measured at the points that lie both near the grain boundaries and deep within the grain, along line that crosses the grain boundary at the right angle. The measurements were repeated for various bias voltages. The geometry is indicated by the bright solid line in figures 5(b)–(e). With the increase of the bias voltage, the conduction path broadens. Initial broadening is slow, the currents are weak, and the path is narrow as long as the bias voltage is below the band gap. At the bias voltage of about 4 V, which is larger than the band gap, the path suddenly broadens dramatically, and the local currents increase. At such high biases, the interior of the grain also begins to conduct. Similar behavior was previously observed in doped $BiFeO_3$ film [28].

In order to better understand the microscopic charge transport process in the grain boundaries, we have measured the I–V characteristics across the grain boundary and observed the changes in the conduction. A pair of particularly large grains and the boundary between them have been chosen, so that we can reach a relatively high spatial resolution when compared to the dimensions of the grains. Figure 7 shows topography (a) and C-AFM image (b) under the 4 V bias with a line across the grain boundary and 11 points on it. The I–V characteristics taken at these points are shown in figure 7(c). As a general trend, the grain boundaries have almost Ohmic behavior, but at the point in the grain interior, the I–V characteristics are typical of semiconductors. Figure 7(d) shows the evolution of the band gap across the grain boundary. We have found the band gap of about 3.2 eV on the grain interior, consistent with the measurements on other grains, see figure 3. As the probe approaches the boundary, the band gap narrows down. At the

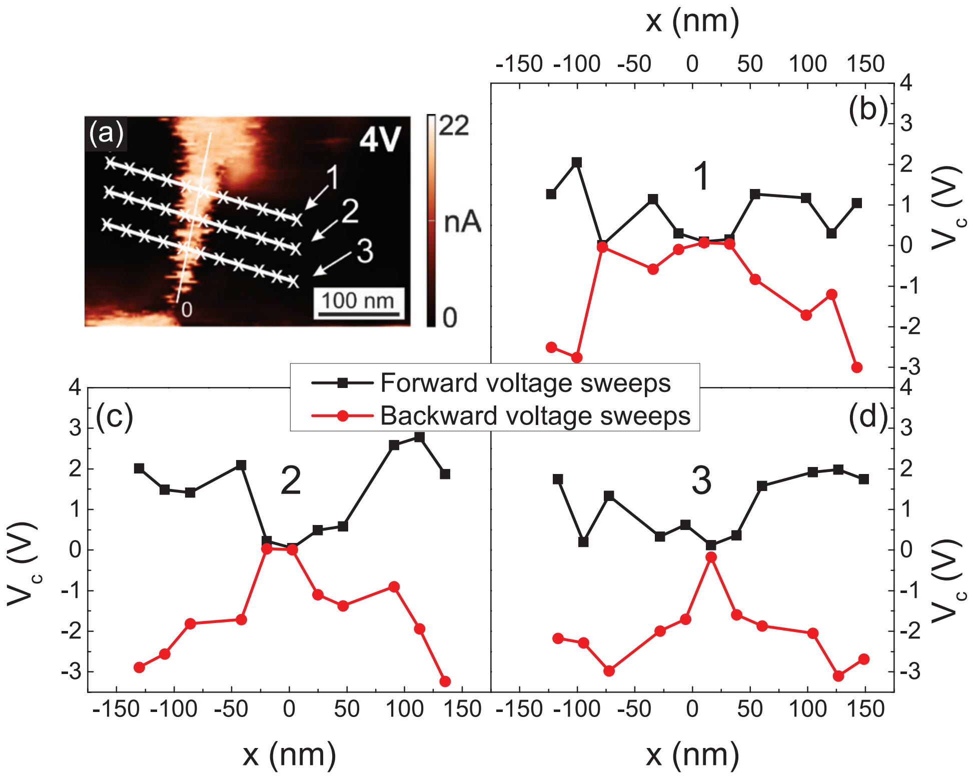

Figure 9. (a) C-AFM image with 3 lines across grain boundary and ((b)–(d)) center of band gap across lines 1, 2, and 3 in the C-AFM image. Solid lines are a guide to the eye.

three points located at the grain boundary (5, 6, and 7) the band gap is very narrow, and the material behaves similarly to a conductor. The fact that we do not find the band gap to be constant across the sample suggests that, at the level of single grains, the film is not homogeneous with well-defined and constant band structure throughout the sample.

The hysteretic dependence of polarization on the external electric field is well known in bulk ferroelectric $BiFeO_3$. The hysteretic phenomena are necessary for the applications of $BiFeO_3$ films in memory devices. Reorganization of charge associated with the variation of electric polarization causes strong internal fields in the sample, and we may expect similar hysteretic behavior in the quantities related to the charge transport. The I–V characteristics and the phenomenon of resistive switching in polycrystalline thin films shows some signatures of the hysteresis [37–39]. However, the hysteresis of electric polarization in the electric field exists only in insulators, whereas the conductors cannot support the electric fields in the interior. We have studied the local hysteresis in the I–V curves, and have probed both the region where the grain is insulating, i.e. the grain interior, and the region where the grain is conductive, i.e. the grain boundary. We have defined the hysteresis width, w, as the difference of voltage that produces a 10 nA current in forward- and backward voltage sweep, see figure 8. The hysteresis width vanishes at the grain boundary, and turns on in the interior with the characteristic length scale of 50 nm, see inset of figure 8. The measured points are presented in figure 7(b). Figure 8 shows the I–V curves in the forward and backward sweep at the grain interior (thick line) and at the grain boundary (thin line). Note that the typical grain diameter is 40 nm.

The bulk $BiFeO_3$ shows both the ferroelectric and the antiferromagnetic order. Both orders are characterized by hysteretic response to external fields. We have found the hysteresis in conductivity in the interior of the grain, but not at the grain boundary (see figure 8). Another property of the grain that can be studied locally is the density of states. We have measured the local density of states across the grain boundary and have found, again, the hysteretic behavior within the grain interior, but not on the boundary. We have chosen the center of the band gap as a representative quantity that describes the band structure. The definition of the center of band gap is illustrated graphically in the supplementary material (stacks.iop.org/JPhysD/49/045309/mmedia). In a series of C-AFM measurements, we have measured the density of states in a forward- and backward voltage sweeps at a set of points that extends across the grain boundary.

Figure 9(a) shows a C-AFM image of grain boundary. Within this region, we have recorded 11 I–V curves through three different lines (see picture). Three representative lines (1–3) across the leakage current pathways of different widths are selected for detailed study of the local density of states. The center of flat plateau in the I–V characteristics is defined as the center of the band gap. Figures 9(b)–(d) show the potential at the band gap centers, V_c, across marked lines 1–3 in figure 9(a).

The density of states is hysteretic, and the center of the band gap is hysteretic within the grain, but not within the boundary layer, see figure 9. The motion of the center of the band gap, V_c, as the probe position x moves in real space across the grain boundary is more pronounced in the backward voltage sweeps, and less in the forward ones. The local hysteresis is manifested by the difference in the positions of the band gap centers as measured in the forward- and backward voltage sweeps while the position of the probe within the sample is kept fixed. Comparison of the $V_c(x)$ curves from the figures 9(b)–(d) with the image of conductivity obtained by C-AFM shows that the narrower boundary region as defined by conductivity (figure 9(a)) also implies a narrower region with the absent hysteresis in $V_c(x)$ (figures 9(b)–(d)). Note, however that the boundary region as would naively be defined from $I(V)$ is much narrower than the absence of hysteresis would imply.

In thin $BiFeO_3$ films, a similar shift of the band gap was observed at the ferroelectric domain boundaries [40]. Discontinuity in polarization and the consequent charge accumulation on the surface causes potential discontinuity and moves the band gap. Such a potential difference should enhance the electrical conductivity by causing carriers in the material to accumulate at the domain wall to screen the polarization discontinuity [41, 42]. In our sample, the grains are single domains, see above, and a similar charge accumulation appears at the boundaries between the grains.

4. Conclusions

We have observed a difference in electrical properties between the grain interior and the grain boundary in $BiFeO_3$ thin film obtained by sol–gel spin coating process. Leakage current was more pronounced at the grain boundaries. The onset of large leakage current with the increasing bias voltage happens as the region of large conductivity expands from the grain boundaries towards the grain interiors. The leakage mechanism in grain interior have been identified with Schottky and Fowler–Nordheim processes, while the leakage current through the grain boundaries does not appear to be dominated by any standard mechanism of conduction. In the measurement with the local probes, we have also found that the band gap varies slightly among the different grains, but varies strongly between the grain boundary and the grain interior. In the grain interior, we have observed hysteresis in various properties of the material connected to the charge transport. The shape of the density of states is itself hysteretic. As a consequence, the conductivity as a function of slowly varying voltage is also hysteretic. As opposed to the grain interior, no hysteresis was observed with the local probe at the grain boundary.

Acknowledgments

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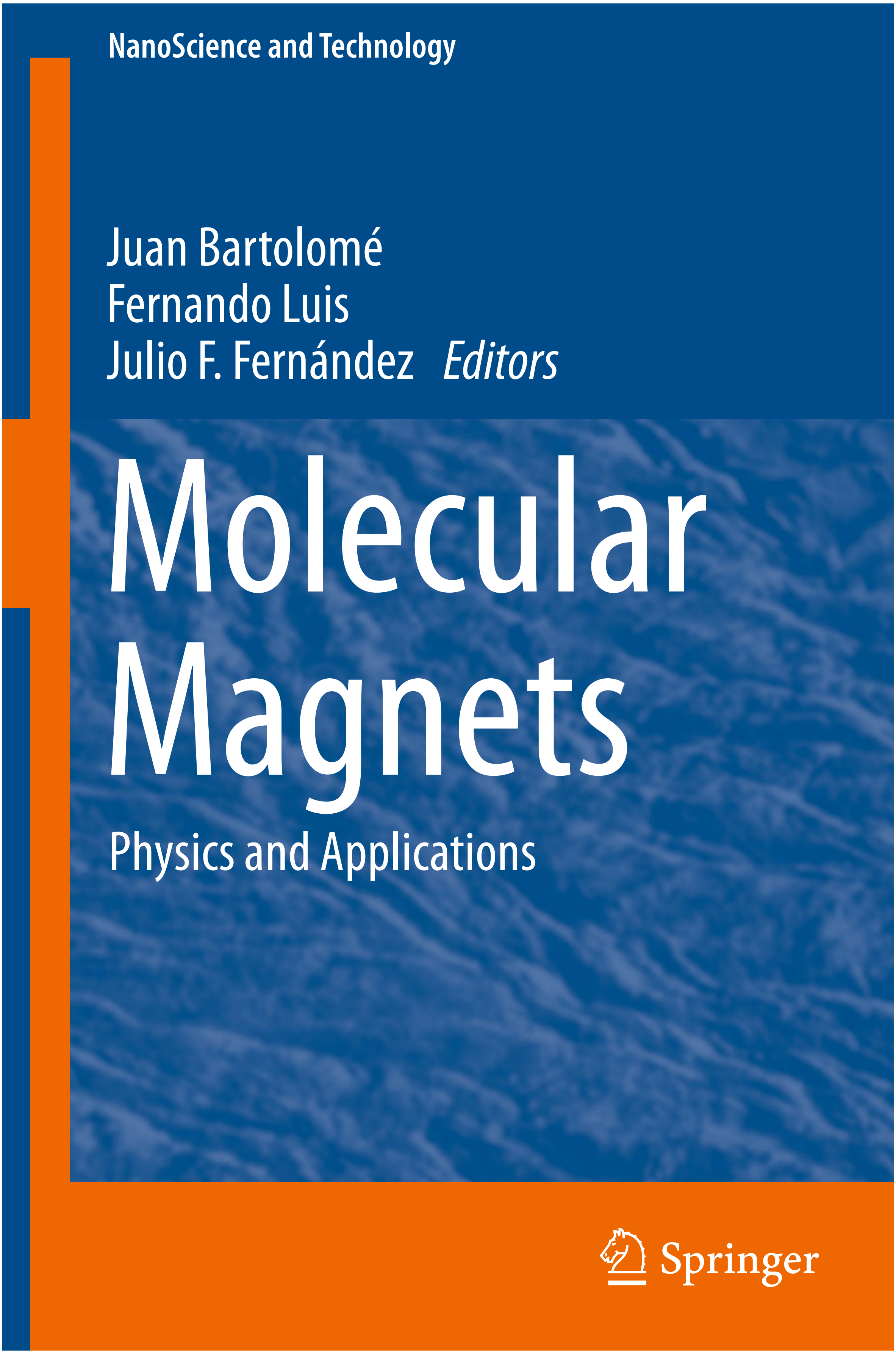
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Part II Beyond Single Molecules

Chapter 11
Molecular Magnets for Quantum Information Processing

Kevin van Hoogdalem, Dimitrije Stepanenko, and Daniel Loss

Abstract In this chapter we will examine the possibility of utilizing molecular magnets for quantum information processing purposes. We start by giving a brief introduction into quantum computing, and highlight the fundamental differences between classical- and quantum computing. We will introduce the five DiVincenzo criteria for successful physical implementation of a quantum computer, and will use these criteria as a guideline for the remainder of the chapter. We will discuss how one can utilize the spin degrees of freedom in molecular magnets for quantum computation, and introduce the associated ways of controlling the state of the qubit. In this part we will focus mainly on the spin-electric effect, which makes it possible to control the quantum states of spin in molecular magnets by electric means. We will discuss ways to couple the quantum state of two molecular magnets. Next, we will identify and discuss the different decoherence mechanisms that play a role in molecular magnets. We will show that one of the advantages of using molecular magnets as qubits is that it is possible to use degrees of freedom that are more robust against decoherence than those in more traditional qubits. We briefly discuss preparation and read-out of qubit states. Finally, we discuss a proposal to implement Grover's algorithm using molecular magnets.

11.1 Introduction

Conceptually, a computer is a device that takes an input and manipulates it using a predetermined set of deterministic rules to compute a certain output. Both input and output are defined in terms of bits, classical physical systems which can be in one of two different states. These states are typically denoted 0 and 1. The set of rules that a computer uses for a computation, also named the algorithm, can be described by a set of gates. A simple example of a gate is the one-bit NOT-gate, which gives a 1 as output when the input is 0, and vice versa. An example of a two-bit

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gate is the NAND-gate, which gives a 0 as output only if both the input bits are 1, and yields a 1 otherwise. Interestingly, it can be shown that any classical algorithm can be implemented using a combination of NAND-gates only. However, this completeness theorem does not state anything about the time in which a certain problem can be solved. Instead, such questions belong to the field of computational complexity theory [1]. A large class of problems, called NP, contains all the problems for which a candidate solution can be checked in polynomial time. In contrast, the class of problems that can be solved in polynomial time is called P. Whether P is a strict subset of NP is one of the great open problems in mathematics. It is widely believed that there are problems in the difference between P and NP. Some of the candidates were shown to be solvable using a quantum computer, but an efficient solution on a classical computer is unknown. This inability of a classical computer to solve certain problems efficiently is one of the main driving forces behind the study of quantum computation. Heuristically one might argue that, since classical computers are governed by Newtonian mechanics—which is only valid in certain limits of the underlying quantum theory—a quantum computer must have computational power which is at least the same as, and hopefully greater than, that of a classical computer [2]. Different algorithms exist that support the claim that a quantum computer is inherently more powerful than a classical computer. Among these are Deutsch-Jozsa's [3, 4], Grover's [5], and Shor's algorithm [6].

Besides being interesting from this pragmatic point of view, quantum computing is also of fundamental importance in the fields of information theory and computer science. The fact that quantum mechanics plays a role in information theory becomes clear when one realizes that abstract information is always embedded in a physical system, and is therefore governed by physical laws. This was made explicit by Deutsch [7], when he proposed a stricter version of the Church-Turing hypothesis, emphasizing its 'underlying physical assertion'. The original Church-Turing hypothesis loosely states that every function which would naturally be regarded as computable can be computed by the universal Turing machine [8, 9], and this statement can be seen as the basis underlying computer science. In a sense, a universal Turing machine is a theoretical formalization of a computer (with an infinite memory) as we described it previously. Deutsch replaces this hypothesis by his more physical Church-Turing principle: 'Every finitely realizable physical system can be perfectly simulated by a universal model computing machine operating by finite means'. He then went on to show that the universal Turing machine does not fulfill the requirements for a universal model computing machine, while the universal quantum computer, proposed in the same work, is compatible with the principle. In this way, the universal quantum computer takes the role of the universal Turing machine.

The basic unit of information in a quantum computer is a qubit [10]. Like a classical bit, a qubit is a physical two-level system, with basis states denoted by $|0\rangle$ and $|1\rangle$. Unlike a classical bit, however, a qubit is a quantum system. This makes the information stored in a qubit ultimately analog, since a qubit can be in any state $|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$, with α and β complex numbers such that $|\alpha|^2 + |\beta|^2 = 1$. In a quantum computer, a gate will act linearly on a state $|\psi\rangle$, and hence in a sense on

$|0\rangle$ and $|1\rangle$ simultaneously. This quantum parallelism is one of the advantages of a quantum computer. Of course, one must keep in mind that reading out the qubit (measuring the state) collapses the quantum state into one of the basis states $|0\rangle$ or $|1\rangle$, so this parallelism cannot be used trivially. The other key advantage of using quantum computing is the fact that two qubits can be entangled, i.e. there can exist non-classical correlations between two qubits. The final important property of qubits is captured by the no-cloning theorem [11], which states that it is impossible to copy an unknown quantum state. This theorem invalidates the use of classical error-correction methods -which are typically based on redundancy, and therefore require copying of bits- for quantum computation. Instead, one has to resort to quantum error-correction codes that rely upon entanglement and measurement, but do not require an ability to copy an unknown quantum state.

Quantum mechanics dictates that the time evolution of an isolated quantum state is described by a unitary operator. This means that the action of any valid quantum gate must also be described by a unitary operator. In fact, it turns out that this is the only requirement on a valid quantum gate. Consequently, there exists a rich variety of quantum gates: Where the only non-trivial classical one-bit gate is the NOT-gate, any rotation in the one-qubit Hilbert space is a quantum gate. As an important example of a one-qubit gate that has no classical analog we mention the Hademard-gate, which transforms $|0\rangle$ into $(|0\rangle + |1\rangle)/\sqrt{2}$ and $|1\rangle$ into $(|0\rangle - |1\rangle)/\sqrt{2}$. An example of a two-qubit gate is the CNOT-gate, which acts as a NOT-gate on the second qubit when the first qubit is in the state $|1\rangle$, and does nothing otherwise. It can be shown that arbitrary single qubit rotations together with the CNOT-gate are sufficient to implement any two-qubit unitary evolution exactly [12].

After all these theoretical considerations, one might wonder what is actually required to build a physical quantum computer. The requirements have been succinctly summarized by DiVincenzo, in terms of his five DiVincenzo criteria for successful implementation of a quantum computer [2]. In order to have a functional quantum computer we need

- a collection of well-defined physical quantum two-level systems (qubits), which should be well-isolated and scalable, i.e. it should be possible to add qubits at will.
- a procedure to initialize the system in an initial state, for instance $|00\ldots0\rangle$.
- the ability to perform logic operations on the qubits, i.e. one- and two-qubit gates.
- long enough decoherence times compared to the 'clock time' of the quantum computer for quantum error correction to be efficient.
- the ability to read out the final state of the qubit.

Satisfying these criteria in a single system simultaneously has turned out to be quite a tour de force. Although tremendous progress -both theoretical and experimental-towards completion of this goal has been made in a wide variety of different areas of solid state physics, it is at this point not clear which system will turn out to be most suitable. Of all the systems that have been proposed as a basis for qubit, we mention here quantum dots [13, 14], cold trapped ions [15], cavity quantum electrodynamics [14, 16], bulk nuclear magnetic resonance [17], low-capacitance

Josephson junctions [18], donor atoms [19, 20], linear optics [21], color centers in diamond [22–24], carbon nanotubes [25], nanowires [26], and lastly the topic of this chapter: Molecular magnets [27–32].

11.2 Encoding of Qubits in Molecular Magnets

We have seen that information in a quantum computer must be encoded in qubits, i.e. well-defined physical quantum two-level systems. Probably the first candidate for a qubit that comes to mind is a single spin in for example an atom. However, experimentally it would be very challenging to control this single spin, since the length scale on which this control would have to take place is prohibitively small. On the other side of the spectrum, solid state implementations of qubits such as Ref. [13] require fields on the scale of several tens to hundreds of nanometers only, making control of the state easier (though still very hard). However, with the increased size we pay the price of additional sources of decoherence, and a huge effort has been made in recent years to combat these sources. For molecular magnets, the requirements on the spatial scale on which control has to be possible are loosened with respect to those for a single spin, because the typical size of such systems is relatively large. However, molecular magnets are still small as compared to other solid states implementations of qubits. This fact, as well as the possibility of chemically engineering molecular magnets with a wide variety of properties, may make one hopeful that sources of decoherence in molecular magnets can be suppressed. Indeed, we will show later that such suppression is possible by choosing the degree of freedom that encodes the qubit wisely.

On the other hand, since molecular magnets have a complex chemical structure containing many interacting magnetic atoms, it is not a priori clear that it will be possible to identify a well-separated, stable, and easily controllable two-level subspace in the spectrum. As we will show next, the fact that this does in fact turn out to be possible is due to the high symmetry of the molecule and the existence of well-separated energy scales. We have seen in previous chapters that molecular magnets can—to a very good approximation—be described by a collection of coupled spins. The low-energy multiplet of the system is then described by a spin-multiplet with fixed total spin, separated from excited states on an energy scale set by the exchange interaction. This low-energy multiplet has either maximal total spin for ferromagnetically coupled individual spins, or minimal total spin for antiferromagnetically coupled spins. In the latter case, the details of the ground state are then determined by the symmetry of the molecule, and frustration can play an important role.

The first requirement which has to be fulfilled by any qubit-candidate is that the physical system has to show genuine quantum behavior. Quantum behavior of the spin state in molecular magnets has been shown in experiments on quantum tunneling of magnetization [33–40], and shows up in hysteresis curves of ferromagnetic (although similar effects are predicted to occur in anitferromagnetic systems [41, 42]) molecular magnets with large spin and high anisotropy barrier [36, 37, 43–45]. In the absence of external fields, the barrier due to the anisotropy lifts the degeneracy between states with different magnetization, and leads to the existence of long-lived spin states. Transitions between different spin states can be driven in a coherent manner, and manifest themselves as stepwise changes in the magnetization. The fact that the transitions show interference between transition paths and Berry phase effects are a signature of their coherent nature [46–52].

Quantum computing in antiferromagnetically coupled spin clusters was studied in Ref. [29]. In the simplest cases of a spin chain or a bipartite lattice with an odd number of spins the degenerate ground state is a spin doublet with effective total spin $1/2$. The total spin can be controlled by an applied magnetic field just as a single spin can, and exchange interaction between two clusters can be introduced by coupling single spins in the two different clusters. A downside of using a collection of spins is that generally decoherence increases with number of spins, unless one manages to encode the qubit in a state which is protected due to symmetry, something we will come back to later. In Ref. [30], Cr-based AFM molecular rings, and specifically Cr_7Ni, were proposed as suitable qubit candidates.

An interesting way of encoding a qubit is offered by geometrically frustrated molecules [32, 53]. Exemplary molecules that display geometric frustration are antiferromagnetic spin rings with an odd number of spins. The simplest example of such a system is given by an equilateral triangular molecule with a spin-1/2 particle at each vertex, such as is for instance realized to a good approximation in Cu_3 (we will use Cu_3 as an abbreviation for the molecule $Na_9[Cu_3Na_3(H_2O)_9(\alpha\text{-}AsW_9O_{33})_2]\cdot 26H_2O$) (see Ref. [54]). Spin rings (of which the spin triangle is the simplest non-trivial example) in general are described by the Heisenberg Hamiltonian with Dzyaloshinskii-Moriya interaction

$$H_0 = \sum_{i=1}^{N} J_{i,i+1}\mathbf{S}_i \cdot \mathbf{S}_{i+1} + \mathbf{D}_{i,i+1} \cdot (\mathbf{S}_i \times \mathbf{S}_{i+1}). \tag{11.1}$$

Here, N is the number of spins in the ring, and $\mathbf{S}_{N+1} = \mathbf{S}_1$. For the triangular molecular magnet $N = 3$. Furthermore, the fact that the point group symmetry of the triangular molecule is D_{3h} imposes the constraints $J_{i,i+1} = J$ and $\mathbf{D}_{i,i+1} = D\hat{\mathbf{z}}$ on the parameters of the Hamiltonian of an planar molecule. Since we are considering antiferromagnetic systems, J is positive. In a Cu_3 molecule, $|J|/k_B \sim 5$ K and $|D|/k_B \sim 0.5$ K. Due to this separation of energy scales, and in the absence of strong magnetic- or electric fields, the Hilbert space containing the 8 eigenstates of the triangular molecule can be split up in a high-energy quadruplet with total spin $\mathbf{S} = 3/2$ and a low-energy quadruplet with total spin $\mathbf{S} = 1/2$. The splitting between the two subspaces is $3J/2$.

In the absence of Dzyaloshinskii-Moriya interaction the low-energy subspace is fourfold degenerate. The eigenstates are given by

$$|1/2, \pm 1\rangle = \frac{1}{\sqrt{3}} \sum_{j=0}^{2} e^{\pm i 2\pi j/3} C_3^j |\uparrow\downarrow\downarrow\rangle, \tag{11.2}$$

and $|-1/2, \pm 1\rangle$. The latter states are also given by (11.2) but with all the spins flipped. These states are thusly labeled as $|m_S, m_C\rangle$, with m_S the quantum number belonging to the z projection of the total spin of the triangle, and m_C the z projection of the chirality of the molecular magnet. The chirality operator **C** has components

$$\begin{aligned} C_x &= -\frac{2}{3}[\mathbf{S}_1 \cdot \mathbf{S}_2 - 2\mathbf{S}_2 \cdot \mathbf{S}_3 + \mathbf{S}_3 \cdot \mathbf{S}_1], \\ C_y &= \frac{2}{\sqrt{3}}[\mathbf{S}_1 \cdot \mathbf{S}_2 - \mathbf{S}_3 \cdot \mathbf{S}_1], \\ C_z &= \frac{4}{\sqrt{3}}\mathbf{S}_1 \cdot [\mathbf{S}_2 \times \mathbf{S}_3]. \end{aligned} \tag{11.3}$$

The chirality contains information about the relative orientation of the spins that make up the molecule. Like the components of the total spin operator, the components of the chirality operator obey angular momentum commutation relations. It is straightforward to show that the total spin and chirality commute. We will show later that states with opposite chirality are split by an energy gap which is determined by the magnitude of the Dzyaloshinskii-Moriya interaction. Furthermore, we can separate states with opposite total spin by applying a magnetic field. This allows us to choose which doublet makes up the ground state, chirality or total spin. In this way it is possible to either encode the qubit in the total spin of the molecule or in the chirality. Furthermore, even thought the commutation relations of the chirality components are the same as those of the spin components, the transformation properties of spin and chirality under rotations, reflections, and time-reversal do differ. Therefore, interactions of chirality with external fields can not be inferred from the analogy with spins. We will discuss later how using the chirality offers certain benefits with regards to the possibility to control the qubit and with regards to increasing the decoherence time of the qubit.

11.3 Single-Qubit Rotations and the Spin-Electric Effect

If one chooses to encode a qubit in a spin state -be it the spin of an electron in a quantum dot, or the total spin of a molecular magnet- the most intuitive way to implement a one-qubit gate is by utilizing the Zeeman coupling $\mu_B \mathbf{B} \cdot \bar{\bar{g}} \cdot \mathbf{S}$, where $\bar{\bar{g}}$ is the g-tensor. This coupling in principle allows one to perform rotations around an arbitrary axis by applying ESR (electron spin resonance) pulses. Indeed, it has been shown to be possible to implement single spin rotations on a sub-microsecond time scale using ESR techniques in quantum dots [55]. Furthermore, Rabi-oscillations of the magnetic cluster V_{15} have been shown to be possible, also on a sub-microsecond time scale [56]. At the moment, however, it appears experimentally very challenging to increase the temporal- and spatial resolution with which one can control magnetic fields to the point that is required for quantum computation in molecular magnets (i.e. nanosecond time scale and nanometer length scale).

For this reason, a large effort has been made to find alternative ways to control the spin state of molecular magnets. One natural candidate to replace magnetic manipulation is electric control. Strong, local electric fields can be created near a STM tip, and these fields can be rapidly turned on and off by applying an electric voltage to electrodes that are placed close to the molecules that are to be controlled.

Electric manipulation requires a mechanism that gives a sizable spin-electric coupling. In quantum dots, the mechanism behind this coupling is the relativistic spin-orbit interaction (SOI), and experiments that show that it is possible to perform single spin rotations by means of electric dipole spin resonance (EDSR) have been proposed [57] and performed [58]. Unfortunately, the fact that this effect scale with the system size L as L^3 makes them unsuitable for molecular magnets, which are much smaller.

Instead, in Ref. [32], Trif et al. proposed a mechanism that leads to spin-electric coupling in triangular magnetic molecules with spin-orbit interaction and broken inversion symmetry. The mechanism relies on the fact that in such systems an electric field can alter the exchange interaction between a pair of spins within a molecule due to the field's coupling to the dipole moment of the connecting bond.

The lowest order coupling between electric field and the spin state of the triangular molecule is given by the electric-dipole coupling, through the Hamiltonian $H_{\text{e-d}} = -e\sum_i \mathbf{E}\cdot\mathbf{r}_i \equiv -e\mathbf{E}\cdot\mathbf{R}$. Here, e is the electron charge and $\mathbf{r}_i$ is the position of the i-th electron. The total dipole moment of the molecule is given by $-e\sum_i \mathbf{r}_i = -e\mathbf{R}$. Because of the D_{3h} symmetry of the molecule, the diagonal elements of total dipole moment operator must vanish in the proper symmetry-adapted basis. However, the electric-dipole coupling can mix states with different chirality. The nonzero matrix elements are the ones that are invariant under the symmetry-transformations of the triangular magnet. Since the $|m_S, \pm 1\rangle$ states and the operators $\pm X + iY$ both transform as the irreducible representation E' of the group D_{3h}, it follows that the only nonzero components in the low-energy subspace of the triangular molecules are

$$\langle m_S, \pm 1|-eX|m'_S, \mp 1\rangle = i\langle m_S, \pm 1|-eY|m'_S, \mp 1\rangle \equiv d\delta_{m_S, m'_S}. \tag{11.4}$$

Coupling to the $S = 3/2$ subspace is suppressed by the finite gap between the two subspaces. By its very nature, this symmetry analysis cannot yield any information on the magnitude of the effective electric dipole parameter d. This information will have to be extracted using other methods, such as ab initio modeling, Hubbard modeling, or experiments, something we will come back to later. We do note that a finite amount of asymmetry of the wave functions centered around each vertex of the triangle is required for the matrix elements in (11.4) to be nonzero. This asymmetry is caused by the small amount of delocalization of the electron states due to the exchange interaction with the states on the other vertices and creates the finite dipole moment of individual bonds. The dipole moment of the bonds, furthermore, must depend on the relative orientation of the two spins which are connected by that bond (i.e. whether they are parallel or anti-parallel) in order for the matrix elements in (11.4) to be nonzero.

Since the electric-dipole coupling connects states with different chirality, we can rewrite it in terms of the vector $\mathbf{C}_\parallel = (C_x, C_y, 0)$ as $H^{\text{eff}}_{\text{e-d}} = d\mathbf{E}'\cdot\mathbf{C}_\parallel$. The vector $\mathbf{E}'$ is given by $\mathbf{E}' = \mathcal{R}(7\pi/6 - 2\theta)\mathbf{E}$, where $\mathcal{R}(\phi)$ describes a rotation by an angle ϕ

around the z axis, and θ is the angle between $\mathbf{r}_1 - \mathbf{r}_2$ and $\mathbf{E}_\parallel = (E_x, E_y, 0)$. With the definition of the chirality operator as given in (11.4), we can rephrase the effective electric-dipole Hamiltonian in terms of exchange coupling between the individual spins

$$H^{\text{eff}}_{\text{e-d}} = \frac{4dE}{3} \sum_{i=1}^{3} \sin\left[\frac{2\pi}{3}(1-i) + \theta\right] \mathbf{S}_i \cdot \mathbf{S}_{i+1}, \qquad (11.5)$$

where E is the magnitude of the in plane components of the electric field. Since the change in the exchange interaction $J_{i,i+1}$ is proportional to $|\mathbf{E}_\parallel \times (\mathbf{r}_{i+1} - \mathbf{r}_i)|$, only the component of the electric field that is perpendicular to the bond $\mathbf{r}_{i+1} - \mathbf{r}_i$ affects the exchange interaction $J_{i,i+1}$. This is consistent with the picture that the finite dipole moment of the bond between two vertices is caused by the deformation of the wave function due to exchange interaction. Otherwise, the strength of the coupling is completely determined by the parameter d. The fact that the change in $J_{i,i+1}$ is not uniform is crucial here, since therefore $[H_0, H^{\text{eff}}_{\text{e-d}}] \neq 0$ even in the absence of DM interaction, which allows the electric-dipole interaction to induce transitions between states with different chirality.

We have seen then that the electric-dipole coupling allows one to perform rotations of the chirality state about the x- and y axis, but not around the z axis (assuming a diagonal g-tensor). This is sufficient to perform arbitrary rotations in chirality space. However, so far the total spin does not couple to the electric field. This situation is remedied when we include spin-orbit interaction.

As with the electric-dipole coupling, one can deduct the form of the spin-orbit interaction from general symmetry considerations. Given the D_{3h} symmetry of the molecule, the most general form of the spin-orbit interaction is

$$H_{\text{SO}} = \lambda^{\parallel}_{\text{SO}} T_{A_2} S_z + \lambda^{\parallel}_{\text{SO}} (T_{E''_+} S_- + T_{E''_-} S_+). \qquad (11.6)$$

Here, T_Γ denotes a tensor which acts on the orbital space and transforms according to the irreducible representation Γ. The nonzero elements in the low-energy subspace are then given by $\langle m_S, \pm 1 | H_{\text{SO}} | m'_S, \pm 1 \rangle = m_S \lambda^{\perp}_{\text{SO}} \delta_{m_S, m'_S}$, which leads to the spin-orbit Hamiltonian $H_{\text{SO}} = \Delta_{\text{SO}} C_z S_z$, where $\Delta_{\text{SO}} = \lambda^{\parallel}_{\text{SO}}$. Alternatively, one can use the fact that the spin-orbit interaction can be described by the Dzyaloshinskii-Moriya term in (11.1). Because of the symmetry of the molecule, the only nonzero component of the DM vector $\mathbf{D}_{i,i+1}$ is the out-of-plane component, so that it takes the form $\mathbf{D}_{i,i+1} = (0, 0, D_z)$. This gives the same form for H_{SO} as the previous considerations, provided one identifies $\lambda^{\parallel}_{\text{SO}} = D_z$.

Combining the results from this section, it follows that the Hamiltonian describing a triangular magnet in the presence of a magnetic- and electric field can be written in terms of the chirality and total spin of the molecule as

$$H = \Delta_{\text{SO}} C_z S_z + \mu_B \mathbf{B} \cdot \bar{\bar{g}} \cdot \mathbf{S} + d\mathbf{E} \cdot \mathbf{C}_\parallel. \qquad (11.7)$$

Hence, for a magnetic field in the z direction, the eigenstates are $|\pm 1/2, \pm 1\rangle$, and an electric field causes rotations of the chirality state, but does not couple states with opposite total spin. When $\mathbf{B}$ is not parallel to $\hat{\mathbf{z}}$, S_z is no longer a good quantum number, and hence an applied electric field can cause rotations in the total spin subspace through the electric-dipole and spin-orbit coupling. In this way it becomes possible to perform arbitrary rotations of the total spin state.

In Ref. [53], the authors were able to identify the parameters of the effective spin Hamiltonian with the parameters of the underlying Hubbard model. On the one hand, this has opened up the possibility to determine the parameters of the effective spin Hamiltonian by means of ab initio calculations [59, 60]. On the other hand, the description of the spin-electric effect in the language of the Hubbard model is useful because it gives an intuitive interpretation of the phenomena that we discussed so far. The Hubbard model description of a molecular magnet including spin-orbit interaction is given by

$$H_{\mathrm{H}} = \sum_{i,j}\sum_{\alpha,\beta}\left[c_{i\alpha}^{\dagger}\left(t\delta_{\alpha\beta} + \frac{i\mathbf{P}_{ij}}{2}\cdot\sigma_{\alpha\beta}\right)c_{j\beta} + \mathrm{H.c.}\right] + \sum_{j} U_j(n_{j\uparrow}, n_{j\downarrow}). \quad (11.8)$$

Here, $c_{i\alpha}^{\dagger}$ creates an electron with spin α whose wave function $|\phi_{i\sigma}\rangle$ is given by a Wannier function located around atom i. Furthermore, t describes spin-independent hopping. The vector $\mathbf{P}_{ij}$ describes spin-dependent hopping due to spin-orbit interaction and hence is proportional to the matrix element $\nabla V \times \mathbf{p}$ between Wannier states centered around atom i and j. The vector σ contains the Pauli matrices. Lastly, U describes the on-site repulsion. Typically, one considers a single-orbital model, and assumes that U is the largest energy scale. A perturbative expansion of (11.8) in $(|t|, |\mathbf{P}_{ij}|)/U$ allows one then to map the Hubbard model on a Heisenberg Hamiltonian with DM interaction [61, 62].

Equation (11.8) describes two scenarios. First, if the index i runs over the three magnetic atoms of the triangle only, it describes coupling between the magnetic atoms through direct exchange. Alternatively, (11.8) can describe the situation in which the coupling between two magnetic atoms is mediated by a non-magnetic bridge by adding a doubly-occupied non-magnetic atom on every line connecting two vertices. The former choice allows for a simpler description, whereas the latter choice is anticipated to be the more realistic one for molecular magnets. We will shortly discuss how either can be used to obtain more insight into the spin-electric effect.

The first thing one can show is that in the case of direct-exchange interaction the basis functions of the Hubbard model to first order in t and $\lambda_{\mathrm{SO}} \equiv \mathbf{P}_{ij}\cdot\mathbf{e}_z$ (due to symmetry $\mathbf{P}_{ij} = \lambda_{\mathrm{SO}}\mathbf{e}_z$) are

$$\left|\Phi_{A_2'}^{1\sigma}\right\rangle = \left|\psi_{A_2'}^{1\sigma}\right\rangle \quad (11.9)$$

$$\left|\Phi_{E_\pm'}^{1\sigma}\right\rangle = \left|\psi_{E_\pm'}^{1\sigma}\right\rangle + \frac{(e^{-2\pi i/3}-1)(t \pm \sigma\lambda_{\mathrm{SO}})}{\sqrt{2}U}\left|\psi_{E_\pm'^1}^{2\sigma}\right\rangle + \frac{3e^{2\pi i/3}(t \pm \sigma\lambda_{\mathrm{SO}})}{\sqrt{2}U}\left|\psi_{E_\pm'^2}^{2\sigma}\right\rangle, \quad (11.10)$$

where $|\psi_{\Gamma}^{n\sigma}\rangle$ denotes the symmetry-adapted eigenstate of the Hubbard model with three electrons, total spin σ, and either single- ($n=1$) or double ($n=2$) occupancy that transforms according to the irreducible representation Γ. Specifically, the spin part of $|\psi_{E'_{\pm}}^{1\sigma}\rangle$ is given by the states $|\sigma, \pm 1\rangle$ in (11.2). It follows that in the limit of $t, \lambda_{\mathrm{SO}} \ll U$ (the limit in which the spin model gives an accurate description) the eigenstates of the Hubbard model are indeed the chirality states. At finite t, λ_{SO}, the eigenstates contain small contributions from doubly-occupied states.

Within the direct-exchange model, the electric field couples to the state of the molecule via two different mechanisms. The first term that has to be added to the Hubbard Hamiltonian comes from the fact that the electric potential takes different values at the positions of the magnetic centers in a molecule, which affects the on-site energy of the electrons as

$$H_{\text{e-d}}^{0} = -e\sum_{\sigma} \frac{E_y a}{\sqrt{3}} c_{1\sigma}^{\dagger} c_{1\sigma} - \frac{a}{2}\left(\frac{E_y}{\sqrt{3}} + E_x\right) c_{2\sigma}^{\dagger} c_{2\sigma} + \frac{a}{2}\left(\frac{E_x}{\sqrt{3}} - E_y\right) c_{3\sigma}^{\dagger} c_{3\sigma}. \tag{11.11}$$

Here, a is the distance between two magnetic atoms. The second contribution is given by

$$H_{\text{e-d}}^{1} = \sum_{i,\sigma} t_{ii+1}^{\mathbf{E}} c_{i\sigma}^{\dagger} c_{i+1\sigma} + \text{H.c.}, \tag{11.12}$$

which describes the modification of the hopping strength due to the electric field. The electric field-dependent hopping is given by $t_{ii+1}^{\mathbf{E}} = -\langle\phi_{i\sigma}|e\mathbf{r}\cdot\mathbf{E}|\phi_{i+1\sigma}\rangle$, and is hence related to the matrix elements of the electric dipole moment which mix the different Wannier functions. As before, a symmetry analysis tells us that the only nonzero matrix elements within the total spin-1/2 subspace are those proportional to

$$\langle\phi_{E'_+}^{\sigma}|ex|\phi_{E'_-}^{\sigma}\rangle = -i\langle\phi_{E'_+}^{\sigma}|ey|\phi_{E'_-}^{\sigma}\rangle \equiv d_{EE}. \tag{11.13}$$

Here, $|\phi_{\Gamma}^{\sigma}\rangle$ describes the linear combination of Wannier states with total spin σ which transforms according to the irreducible representation Γ. One can then calculate the matrix elements of both the electric-dipole coupling as well as the spin-orbit Hamiltonian perturbatively in $(t, eaE, d_{EE}E)/U$. Furthermore, since the electrons are localized, the off-diagonal elements of the dipole moment, d_{EE}, satisfy $d_{EE} \ll ea$. To lowest order the results are

$$|\langle\Phi_{E'_-}^{1\sigma}|H_{\text{e-d}}^{0}|\Phi_{E'_+}^{1\sigma}\rangle| \propto \left|\frac{t^3}{U^3} eEa\right|, \tag{11.14}$$

$$|\langle\Phi_{E'_-}^{1\sigma}|H_{\text{e-d}}^{1}|\Phi_{E'_+}^{1\sigma}\rangle| \approx \left|\frac{4t}{U} E d_{EE}\right|, \tag{11.15}$$

$$|\langle\Phi_{E'_-}^{1\sigma}|H_{\mathrm{SO}}|\Phi_{E'_+}^{1\sigma}\rangle| = \pm\frac{5\sqrt{3}\lambda_{\mathrm{SO}} t}{2U}\operatorname{sgn}(\sigma). \tag{11.16}$$

These first two matrix elements can be identified with the matrix elements in (11.7) that mix the states with different chirality, and hence determine the parameter d. The last matrix element determines D_z. Therefore, all parameters of the effective spin model in (11.7) can be determined from the underlying microscopic model. In Ref. [60], Nossa et al. utilized the presented analysis to determine the value of D_z and J in the molecular magnet Cu_3 using spin-density functional theory.

It is known that in molecular magnets the direct exchange mechanism is often suppressed due to the localized nature of the electrons that determine the magnetic properties (which are typically of a d-wave nature) combined with the fact that the magnetic atoms are typically separated by non-magnetic bridge atoms. In Cu_3, for instance, exchange interaction between two Cu atoms follows a superexchange path along a Cu-O-W-O-W-O-Cu bond, which makes the Cu atoms third nearest neighbors [54]. A more accurate description on a microscopic basis of the spin-electric effect in a triangular magnet is therefore given by a model which includes a doubly-occupied non-magnetic atom on every line connecting two vertices, so that the mechanism behind the exchange interaction is superexchange. This is further strengthened by the expectation that the orbitals of the magnetic atoms do not deform easily in an electric field, whereas the bridge orbitals are expected to change their shape more easily.

In Ref. [53], the authors analyzed the behavior of a single Cu-Cu bond, including the non-magnetic bridge atom that connects the two Cu atoms, under the application of an electric field. By performing a fourth-order Schrieffer-Wolf transformation [63] on the Hamiltonian (11.8) for such a bond (using $(|t|, |\mathbf{P}_{ij}|)/U$ as small parameter) one can map the Hubbard model on the spin model

$$H_{12} = J\mathbf{S}_1 \cdot \mathbf{S}_2 + \mathbf{D} \cdot (\mathbf{S}_1 \times \mathbf{S}_2) + \mathbf{S}_1 \cdot \boldsymbol{\Gamma} \cdot \mathbf{S}_2. \tag{11.17}$$

Here, $\boldsymbol{\Gamma}$ is a traceless- and symmetric matrix. Equation (11.17) describes the most general quadratic spin Hamiltonian possible. The parameters $J, \mathbf{D}, \boldsymbol{\Gamma}$ can be determined from the parameters of the Hubbard model. Assuming that the bond angle between the Cu atom and the bridge atom is finite, the largest possible symmetry of a single bond with bridge atom is C_{2v}. This determines which spin parameters can be nonzero. If the electric field breaks the C_{2v} symmetry, extra terms can be generated. However, from the C_{2v} symmetry it follows that the strongest spin-electric coupling will be in the plane spanned by the Cu atoms and the bridge atom, and perpendicular to the Cu-Cu bond. This is due to the fact that this is the only direction in which the bond can have a finite dipole moment in the absence of an electric field (due to the molecular field), which gives rise to linear electric-dipole coupling. Indeed, it is this coupling that causes the effective Hamiltonian in (11.5), with effective electric-dipole moment given by

$$d = \frac{4}{U^3}\big[\big(48t^3 - 20tp_z^2\big)\kappa_t + \big(-20t^2 p_z + 3p_z^3\big)\kappa_{pz}\big]. \tag{11.18}$$

Here, t is the hopping parameter, p_z is the z component of the spin-orbit hopping, and $\kappa_t = \delta t/E$ and $\kappa_{pz} = \delta p_z/E$ relate the changes in t and p_z to the electric field E.

Using ab initio methods, the authors in Ref. [59] calculated the effective electric-dipole moment d in Cu_3. They found the value $d = 3.38 \times 10^{-33}$ C m. This corresponds to $d \approx 10^{-4} ea$, where a is the length of the Cu-Cu bond, and leads to Rabi oscillation times $\tau \approx 1$ ns for electric field $E \approx 10^8$ Vm^{-1}.

So far, we have only discussed single-qubit rotations. However, for a complete set of quantum gates, we also need a two-qubit gate. In the next section, we will discuss different proposals that have been made on how to implement such a two-qubit gate.

11.4 Two-Qubit Gates

Suppose we chose to encode our qubit states in the spin degrees of freedom of a system. Two-qubit gates such as the CNOT- or the $\sqrt{\mathrm{SWAP}}$-gate can then be implemented by turning on the Heisenberg exchange interaction between two spins for a certain time [64]. For spins in quantum dots, this is relatively simply done by applying appropriate voltage pulses to the gate that controls the tunneling between two quantum dots. In contrast, in molecular magnets the exchange interaction between two molecules is typically determined by the chemistry of the molecule, and one has to search for more sophisticated ways to implement two-qubit gates.

The first method to couple the state of two qubits that we will discuss is based on coupling of two triangular molecular magnets through a quantum mechanical electric field in a cavity or stripline [32]. Such electric fields offer long-range and switchable coherent interaction between two qubits. The electric field of a phonon with frequency ω in a cavity of volume V is given by $\mathbf{E}_0(b_\omega^\dagger + b_\omega)$, where $b_\omega^\dagger$ creates a photon with frequency ω and the amplitude of the field is $|\mathbf{E}_0| \propto \sqrt{\hbar\omega/V}$. The coupling of such a photon to the in plane component of the chirality $\mathbf{C}_\parallel$ of a triangular molecule is then given by $\delta H_\mathrm{E} = d\mathbf{E}_0' \cdot \mathbf{C}_\parallel (b_\omega^\dagger + b_\omega)$. In the rotating wave approximation, the Hamiltonian that describes the low-energy subspace of N triangular molecular magnets which interact with the photon field is given by $H_{\text{s-ph}} = \sum_j H^{(j)} + \hbar\omega b_\omega^\dagger b_\omega$, with

$$H^{(j)} = \Delta_{\mathrm{SO}} C_z^{(j)} S_z^{(j)} + \mathbf{B} \cdot \bar{\bar{g}} \cdot \mathbf{S}^{(j)} + d|\mathbf{E}_0|\big[e^{i\phi_j} b_\omega^\dagger C_-^{(j)} + \mathrm{H.c.}\big]. \tag{11.19}$$

Here, $\phi_j = 7\pi/6 + \theta_j$. Application of a magnetic field $\mathbf{B}$ with an in plane component allows one to couple both the chirality as well as the total spin degrees of freedom of spatially separated molecules. This coupling can be turned on and off by bringing the molecules in resonance with the photon mode, by applying an additional local electric field. One difficulty in using cavities is that the electric fields are weaker than those at an STM tip. A typical value is $|\mathbf{E}_0| \approx 10^3$ V m^{-1}, which leads to Rabi times $\tau \approx 0.01$–100 μs.

For the discussion of another proposed implementation of an electrically controlled two-qubit gate (in this case the $\sqrt{\mathrm{SWAP}}$-gate), we turn our attention to the polyoxometalate $[PMo_{12}O_{40}(VO)_2]^{q^-}$. This molecule consists of a central mixed-valence core based on the $[PMo_{12}O_{40}]$ Keggin unit, capped by two vanadyl groups containing one localized spin each [31]. In such a molecule, one can encode a two-qubit state in the spins of the vanadyl groups. The spins of the two vanadyl groups are weakly exchange coupled via indirect exchange interaction mediated by the core. The crucial property of the core is that one can tune the number of electrons it contains, since the exchange interaction between the vanadyl spins depends on the number of electrons on the core. Namely, if the core contains an odd number of electrons, the spin of the unpaired electron on the core couples to those of the vanadyl groups, and the effective interaction between the two qubits is relatively strong. In contrast, for an even number of spins on the core, the spins on the core pair up to yield a ground state with total spin 0. In this case, the exchange interaction between the pair of vanadyl spins is strongly reduced as compared to the situation with an odd number of electrons on the core. Since the redox flexibility of such polyoxometalates is typically rather high, the number of electrons n_C on the core can be tuned by electric means, by bringing the molecule near the tip of an STM. The system is then described by the Hamiltonian

$$\begin{aligned} H = & -J(n_C)\mathbf{S}_L \cdot \mathbf{S}_R - J_C(\mathbf{S}_L + \mathbf{S}_R) \cdot \mathbf{S}_C \\ & + (\epsilon_0 - eV)n_C + Un_C(n_C - 1)/2. \end{aligned} \tag{11.20}$$

Here, $\mathbf{S}_{L/R}$ are the spin operators of the two vanadyl groups, and $\mathbf{S}_C$ is the spin of the core. $J(n_C)$ denotes the exchange interaction between the two vanadyl spins. Given the previous discussion, $J(0) \approx 0$. The orbital energy of the electron on the core is given by ϵ_0, and V is the electric potential at the core. Lastly, U is the charging energy of the molecule, which defines the largest energy scale in the problem. We consider the subspace of only $n_C = 0$ or $n_C = 1$ electrons on the core.

The two-qubit $\sqrt{\text{SWAP}}$ is now implemented as follows: One starts out with an electric potential such that the stable configuration has $n_C = 0$ electrons on the core. That way, the two qubits are decoupled. By applying a voltage pulse V_g to the STM tip, one can switch to the state with $n_C = 1$ electrons. The Hamiltonian that describes the spin-state of the molecule is then given by [31]

$$H_1 = -\big[J(1) - J_C\big]\mathbf{S}_L \cdot \mathbf{S}_R - \frac{J_C}{2}\mathbf{S}^2. \tag{11.21}$$

Here, $\mathbf{S} = \mathbf{S}_L + \mathbf{S}_R + \mathbf{S}_C$ is the total spin of the molecule. The time-evolution of the system is determined by (11.21) for the duration τ_g of the pulse, afterwards the two vanadyl spins will be decoupled again. The first part of this Hamiltonian contains the wanted exchange coupling, and one can implement different two-qubit gates depending on the pulse length τ_g. For the $\sqrt{\text{SWAP}}$-gate, this time is given by the condition

$$\big[J(1) - J_C\big]\frac{\tau_g}{\hbar} = \frac{\pi}{2} + 2\pi n, \tag{11.22}$$

where n is an integer. The second term in (11.21) depends on the spin-state of the core, and is unwanted. However, we can get rid of it by choosing the pulse-length such that the unitary evolution associated with the second term is equal to the unit operator. This condition turns out to be satisfied for times

$$\tau_g = \frac{4\pi}{3} \frac{\hbar}{|J_C|} m, \tag{11.23}$$

where m is an integer. Together, these last two equations give a requirement on $J(1)$ and J_C, namely

$$\frac{J(1)}{|J_C|} = \mathrm{sgn}(J_C) + \frac{3}{8} \frac{1-4n}{m}. \tag{11.24}$$

So far, we have assumed that switching between states with $n_C = 0$ and $n_C = 1$ can be perfectly controlled and is instantaneous. In reality, however, this transition is governed by quantum processes, and is a probabilistic process governed by the tunneling rate Γ between STM tip and molecule. Therefore, τ_g is inherently a stochastic quantity. To analyze these quantum effects, the authors in Ref. [31] numerically calculated the averaged fidelity $\mathcal{F} = \sqrt{\rho_{\mathrm{real}}\rho_{\mathrm{ideal}}}$ between the idealized $\sqrt{\mathrm{SWAP}}$-gate with instantaneous switching and the real $\sqrt{\mathrm{SWAP}}$-gate with the stochastic tunneling ($\rho_{\mathrm{real}}/\rho_{\mathrm{ideal}}$ denote the obvious density matrices at the end of the $\sqrt{\mathrm{SWAP}}$-gate operation here). They found that the fidelity can be as high as $\mathcal{F} = 0.99$.

11.5 Decoherence in Molecular Magnets

Up to this point, we have assumed that the evolution of the quantum state of any qubit is unitary, and hence the information content of the qubit is infinitely long-lived. This assumption is only valid for a perfectly isolated system. In reality, however, any qubit will be coupled to its environment. Fluctuations in the environment can then lead to decoherence: The process whereby information about a quantum state is lost due to interaction with an environment. Decoherence of a single qubit typically takes place on two different time scales. The longitudinal decoherence time, or T_1-time, describes the average time it takes the environment to induce random transitions from $|0\rangle$ to $|1\rangle$, and vice versa. The transverse decoherence time, the T_2-time, describes the time it takes a systems to lose its information about the coherence between the $|0\rangle$ and $|1\rangle$ state. In other words, the T_2-time is the time it takes for a system initially in the pure quantum state described by the density matrix $\hat{\rho}_0 = |\psi_0\rangle\langle\psi_0|$, where $|\psi_0\rangle = \alpha|0\rangle + \beta|1\rangle$, to transform into the classical state $\hat{\rho}(t) = |\alpha|^2|0\rangle\langle 0| + |\beta|^2|1\rangle\langle 1|$. In this sense, decoherence is the cause of the transition from the quantum- into the classical regime. The T_1-time sets on upper limit on the time a system can be used as a classical bit, whereas a system can only be used as a qubit for times $T \ll T_1, T_2$. The T_1- and T_2-time of a system are not unrelated, and can indeed become of comparable magnitude in certain systems. For molecular magnets at low temperatures, however, typically $T_2 \ll T_1$.

The first measurement of the T_2-time of a system consisting of molecular magnets was performed by Ardavan et al. in 2007 (Ref. [65]). The measurements were performed on Cr_7M heterometallic wheels (M denotes Ni or Mn), and the authors found T_2-times of 3.8 μs for perdeuterated diluted Cr_7Ni solutions. The typical way to measure relaxation times is to use standard spin-echo techniques [66]. The T_2-time can be obtained from the decay with τ of a 2-pulse Hahn-echo measurement, consisting of the sequence: $\pi/2 - \tau - \pi - \tau -$ echo. In a similar manner, the T_1-time can be determined using the sequence $\pi - T - \pi/2 - \tau - \pi - \tau -$ echo. Here, T is varied, and τ is constant and short. One of the difficulties in measuring the T_2-times in magnetic clusters is the fact that, in a crystal, the different molecules are coupled by dipole-dipole interactions. This limits the T_2-time. The natural approach to avoid this problem is to consider molecules in solution. However, here the problem is that many magnetic clusters with high spin display strong axial anisotropy, with relatively large zero-field splitting. In a solution, these clusters will orient in a random matter. This problem is circumvented by using Cr_7Ni-clusters, which have a $S = 1/2$ ground state (and hence no zero-field splitting), and small anisotropy of the g-factor.

It was found that the main mechanism limiting the T_2 -time of the Cr_7Ni-clusters was coupling to protons. To increase the decoherence time, the authors therefore considered the perdeutered analogue compound. Indeed, according to expectations (^{2}D has a gyromagnetic ratio which is about 1/6 of that of ^{1}H), this increased the coherence time roughly by a factor of 6, leading to a T_2-time of 3.8 μs at 1.8 K.

Our remaining discussion of decoherence in molecular magnets follows that of Ref. [67]. In spin systems, the two most common sources of decoherence are fluctuations in the electric environment (which couple to the spin state via spin-orbit interaction) and fluctuations of the spin state of the N nuclear spins $\mathbf{I}_p$ in the host material of the qubit, which are coupled to the system spins $\mathbf{S}_i$ due to hyperfine interaction. We will mainly focus on the latter mechanism, since it typically limits the decoherence time [56, 65]. The hyperfine interaction between nuclear spins and system spins is due to dipole-dipole interaction as well as contact interaction

$$H_{\mathrm{HF}} = D_{\mathrm{HF}} \sum_i \sum_p \frac{\mathbf{S}_i \cdot \mathbf{I}_p - 3(\mathbf{S}_i \cdot \hat{\mathbf{r}}_{ip})(\mathbf{I}_p \cdot \hat{\mathbf{r}}_{ip})}{r_{ip}^3} + \sum_i a_i \mathbf{S}_i \cdot \mathbf{I}_{q(i)}. \qquad (11.25)$$

Here, $D_{\mathrm{HF}} = (\mu_0/4\pi) g_I \mu_I g_S \mu_S$, and $\mathbf{r}_{ip} = \mathbf{r}_i - \mathbf{r}_p$. The contact interaction strength a_i is due to the finite overlap of the wave functions of the system spin and nuclear spins located at the same magnetic center. For small clusters, the latter term only leads to oscillations of the coherence, and hence we can neglect it [67]. To see how the hyperfine interaction leads to decoherence, let us consider a system in which the state of the qubit and that of the bath are initially uncorrelated. Furthermore, let the initial state of the qubit be given by $|\psi(0)\rangle = \frac{1}{\sqrt{2}}(|0\rangle + |1\rangle)$, and let the bath be prepared in the (mixed or pure) state described by the density operator $\hat{\rho}_n(0) = \sum_{\mathcal{I}} p_{\mathcal{I}} |\mathcal{I}\rangle\langle\mathcal{I}|$. Here, $|\mathcal{I}\rangle = |m_1^{\mathcal{I}}, \ldots, m_N^{\mathcal{I}}\rangle$ with $m_i^{\mathcal{I}}$ the projection of the nuclear spin operator $\mathbf{I}_i$ along the magnetic field. Two examples of possible states the bath may be prepared in are the spin-polarized (pure) state with polarization P, and the equal superposition (mixed) state. In the first case, $p_{\mathcal{I}} = \delta_{\mathcal{I},n}$, where $|n\rangle$ is the state such that $\sum_p I_p^z|n\rangle = \frac{P}{2}|n\rangle$. In the latter case, $p_{\mathcal{I}} = 1/2^N$. This is the initial state of the bath in the absence of an external magnetic field, ignoring interactions between the nuclear spins. Over time, interactions between the bath and the qubit will introduce correlations between the two subsystems, evolving the state $|\Psi_{\mathcal{I}}(0)\rangle = |\psi(0)\rangle \otimes |\mathcal{I}\rangle$ into the state $|\Psi_{\mathcal{I}}(t)\rangle = \frac{1}{\sqrt{2}}(|0,\mathcal{I}_0\rangle + |1,\mathcal{I}_1\rangle)$ (if we consider only loss of phase coherence). In general, the states $|\mathcal{I}_0\rangle$ and $|\mathcal{I}_1\rangle$ will not be the same. Therefore, the reduced density matrix of the qubit, given by $\hat{\rho}_S(t) = \mathrm{Tr}_n[\sum_{\mathcal{I}} p_{\mathcal{I}}|\Psi_{\mathcal{I}}(t)\rangle\langle\Psi_{\mathcal{I}}(t)|]$, may have a decreased degree of coherence (i.e. smaller off-diagonal elements), since the nuclear spins are correlated with the spins of magnetic centers that encode the qubit. The degree of coherence can be quantified by $r(t) = \sum_{\mathcal{I}} P_{\mathcal{I}} r_{\mathcal{I}}(t)$, where $r_{\mathcal{I}}(t) = \langle\mathcal{I}_1(t)|\mathcal{I}_0(t)\rangle$, and $\langle 0|\hat{\rho}_S(0)|1\rangle = r_{\mathcal{I}}/2$. It is known that the decoherence rate depends on the initial state of the nuclear spin bath. For example, it has been shown that techniques such as narrowing of the nuclear state can drastically increase the decoherence times in quantum dot systems [68].

Next, we want to show in what way (11.25) leads to decoherence in a spin-cluster qubit (such as is realized in the triangular magnet in Sect. 11.2) in more detail. We have shown before that in spin clusters the qubit state is typically not encoded in the $\mathbf{S}_i$'s themselves, but instead in quantities like the total spin $\mathbf{S}$ or the chirality $\mathbf{C}$. However, we can always denote the basis states of the qubit by $|0\rangle$ and $|1\rangle$. Quite generally then, by projecting the spin operators $\mathbf{S}_i$ on the space spanned by $|0\rangle, |1\rangle$, and performing a second order Schrieffer-Wolff transformation on the resulting Hamiltonian, one can transform (11.25) into the Hamiltonian $H = \sum_{k=0,1} |k\rangle\langle k| \otimes H_k$, with

$$H_k = \sum_{p=1}^{N} \omega_p^k I_p^{z'} + \sum_{p\neq q} \big(A_{pq}^k I_p^{z'} I_q^{z'} + B_{pq}^k I_p^+ I_q^-\big), \tag{11.26}$$

where $\hat{\mathbf{z}}' = \mathbf{B}/|B|$. In the derivation of (11.26), we ignored terms that do not conserve energy. $\omega_p^0 - \omega_p^1$ is linear in H_{HF}, and the quantities $A_{pq}^0 - A_{pq}^1$ and $B_{pq}^0 - B_{pq}^1$ are quadratic in H_{HF}. The fastest contribution to decoherence is due to inhomogeneous broadening due to the terms $\propto I_p^{z'}$ in (11.26). These terms describes the magnetic field due to the nuclear spins, which is called the Overhauser field. The Overhauser field depends on the specific realization of the nuclear spin state (for times $t \ll \tau_n$, where τ_n is the typical evolution time of the nuclear spin state, the magnetic field is static). Therefore, if the nuclear spins are in a mixture of states, the coherence of the state $|\psi(0)\rangle$ is washed out due interference of the states that undergo time-evolution under different effective magnetic fields. This can be seen from the decoherence factor $r(t)$, which for $t \ll \tau_n$ evolves as $r(t) \approx e^{i(E_0-E_1)t} \sum_{\mathcal{I}} P_{\mathcal{I}} e^{i\delta_{\mathcal{I}} t}$, where

$$\delta_{\mathcal{I}} \approx g_S \mu_S \sum_i \mathbf{B}_{\mathrm{HF}}^{\mathcal{I}}(\mathbf{r}_i) \cdot \big[\langle 0|\mathbf{S}_i|0\rangle - \langle 1|\mathbf{S}_i|1\rangle\big]. \tag{11.27}$$

The sum is over the spins in the spin cluster. Furthermore, $\mathbf{B}_{\mathrm{HF}}^{\mathcal{I}}(\mathbf{r}_i) = D_{\mathrm{HF}} \sum_p m_p^{\mathcal{I}}[\hat{\mathbf{z}}' - 3(\hat{\mathbf{z}}' \cdot \hat{\mathbf{r}}_{ip})\hat{\mathbf{r}}_{ip}]/r_{ip}^3$ is the Overhauser field. It has been shown, that decoherence of a qubit encoded in the total spin $\mathbf{S} = \sum_{i=1}^3 \mathbf{S}_i$ of a triangular cluster due to the distribution of the Overhauser field for the equal superposition mixed state typically takes place on time scales of 100 ns. The second order terms in (11.26) give contributions to the decoherence times that are several orders of magnitude smaller.

We have seen that due to hyperfine interaction, both the qubit state as well as the nuclear spin state evolve in time. Furthermore, even in the absence of hyperfine interaction the nuclear spin state itself evolves in time, according to the Hamiltonian $H_n = \hat{\mathbf{B}} \cdot \sum_p \omega_p \mathbf{I}_p + D_n \sum_{p<q}[\mathbf{I}_p \cdot \mathbf{I}_q = 3(\mathbf{I}_p \cdot \hat{\mathbf{e}}_{pq})(\mathbf{I}_q \cdot \hat{\mathbf{e}}_{pq})]/r_{pq}^3$. This dynamics of the nuclear bath can lead to additional broadening of the Overhauser field, and has been shown to lead to decoherence on the μs-time scale for a qubit state encoded in the total spin.

An interesting possibility to increase the decoherence time of a qubit is a triangular spin cluster was put forward in Ref. [67]. The idea is to use the chirality of cluster as qubit, instead of the total spin. In that case, the states $|0\rangle$ and $|1\rangle$ of this section become $|0\rangle_{C_z} = |-1/2, 1\rangle$, $|0\rangle_{C_z} = |-1/2, -1\rangle$. The crucial property of these state that causes the increased decoherence time is that since

$$\langle 1|S_{z,i}|1\rangle = \langle 0|S_{z,i}|0\rangle = -1/6, \tag{11.28}$$

the Overhauser field from (11.27) does not couple to the qubit. Therefore, decoherence processes in (11.26) are second order only. This can lead to decoherence times approaching milliseconds.

11.6 Initialization and Read-out

Initialization of a qubit in its ground state is arguably the DiVincenzo criterion that is most routinely realized. Therefore, we will not spend a lot of time discussing it here. The way to prepare a qubit in its ground state is by cooling it down to temperatures that are much smaller than the gap between the ground state in which one wants to prepare the system and the first excited state. This gap, which could for instance be due to magnetic anisotropy, is typically of the order of a few Kelvin, and may be controlled by external means, such as placing the molecular magnet in a magnetic field. This limits the temperature at which experiments can be done to several mK to K.

The read-out of the spin state is a topic on itself, and we refer the reader to the literature for an overview of the different techniques that are used [69].

11.7 Grover's Algorithm Using Molecular Magnets

One special topic that we wish to discuss in this chapter is the implementation of Grover's algorithm using molecular magnets [27]. Grover's algorithm can be used to find an entry in an unsorted database with N entries. A typical situation in which this would be required is if we were given a phone number, and wanted to find the associated name in a phone book. Classically, we would have to start with the first entry, and work our way down the list. Finding the name in this manner requires on average $N/2$ queries. If we had encoded the information in the phone book in a quantum state, we would have been able to find the correct entry with high probability in $O(N^{1/2})$ queries using Grover's algorithm. A crucial requirement for this algorithm is the possibility to generate arbitrary superpositions of eigenstates (and in particular the superposition where all eigenstates have approximately the same weight).

In large-spin magnetic molecules, the eigenstates are labeled by the quantum number m_S, the z projection of the total spin $S \gg 1/2$. The Hamiltonian describing a single spin S with easy-axis along the z direction is given by

$$H = -AS_z^2 - BS_z^4 + V, \tag{11.29}$$

where $V = g\mu_B \mathbf{H} \cdot \mathbf{S}$. This gives rise to the typical double-well spectrum with non-equidistant level spacing. Such level spacing is crucial for the proposal in Ref. [27], as will become clear shortly. Suppose one starts out by preparing the system in the ground state $|\psi_0\rangle = |s\rangle$, and wishes to create an equal superposition of all the states $|m_0\rangle, |m_0 + 1\rangle, \ldots, |s - 1\rangle$, where $m_0 = 1, 2, \ldots, s - 1$. This corresponds to using $n - 1$ states for Grover's algorithm, where $n = s - m_0$. In principle, one can create superpositions by applying a weak transverse magnetic field $\mathbf{H}_\perp$ (whose effect can be described using perturbation theory) which drives multiphoton transitions via virtual states through its coupling to S^+, S^-. However, to create the equal superposition that is required for Grover's algorithm, the amplitudes of all k-photon processes (here $k = 1, 2, \ldots, s - m_0$) must be equal. Clearly, perturbation theory is not valid in this regime. Therefore, a more sophisticated scheme is required.

The scheme that is proposed in Ref. [27] to create an equal superposition uses a single coherent magnetic pulse of duration T with a discrete frequency spectrum $\{\omega_m\}$. It contains n high-frequency components and a single low-frequency component ω_0, chosen such that $\hbar\omega_0 \ll \epsilon_{m_0} - \epsilon_{m_0+1}$. Here, ϵ_m is the energy of the eigenstate $|m\rangle$. The frequencies of the n high-frequency components are given by $\hbar\omega_{s-1} = \epsilon_{s-1} - \epsilon_s - \hbar(n-1)\omega_0$ and $\omega_m = \epsilon_m - \epsilon_{m+1} + \hbar\omega_0$ for $m = m_0, \ldots, s-2$. For the molecular magnet Mn_{12}, the high-frequency components have frequencies between 20-120 GHz, and ω_0 is around 100 MHz. Because of the non-equidistant splitting of the energy levels, all frequencies are different. The low-frequency component is applied along the easy axis, the high frequency components are in plane, so that the coupling is given by

$$V_{\text{low}}(t) = g\mu_B H_0(t) \cos(\omega_0 t) S_z, \tag{11.30}$$

$$
\begin{aligned}
V_{\text{high}}(t) &= \sum_{m=m_0}^{s-1} g\mu_B H_m(t)\big[\cos(\omega_m t + \Phi_m)S_x - \sin(\omega_m t + \Phi_m)S_y\big] \\
&= \sum_{m=m_0}^{s-1} \frac{g\mu_B H_m(t)}{2}\big[e^{i(\omega_m t+\Phi_m)}S^+ + e^{-i(\omega_m t+\Phi_m)}S^-\big]. \qquad (11.31)
\end{aligned}
$$

Hence, absorption (emission) of a high-frequency σ^--photon induces a transition with $\Delta m = -1$ (1); the low-frequency π-photons do not change m, instead they supply the energy required to fulfill the resonance condition for allowed transitions. The phases Φ_m can be chosen freely, we will come back to this point later. With this setup, the lowest order transition between the ground state $|s\rangle$ and all states $|m\rangle$ (for $m_0 \le m < s$) is n'th order in $V(t) = V_{\text{low}}(t) + V_{\text{high}}(t)$.

To see this, let us consider an explicit example where $s = 10$, $m_0 = 5$, and hence $n = 5$. The lowest order transition from $|s\rangle$ to $|s-1\rangle$ uses 4 π-photons of energy $\hbar\omega_0$ and 1 σ^--photon with energy $\hbar\omega_{s-1}$. The transition from $|s\rangle$ to $|s-2\rangle$ uses 3 π-photons of energy $\hbar\omega_0$, 1 σ^--photon with energy $\hbar\omega_{s-1}$, and 1 σ^--photon with energy $\hbar\omega_{s-2}$; and so on for the other transitions. ω_0 can be chosen such that lower order transitions are forbidden due to the requirement of energy conservation. The amplitude of higher order transitions is small in the perturbative regime.

Since all transition amplitudes are the same order in $V(t)$, they are all approximately equal. To make them exactly equal requires some fine-tuning. For rectangular pulses with $H_k(t) = H_k$ for $T/2 < t < T/2$, the n'th order contribution to the S-matrix for the transition between $|s\rangle$ and $|m\rangle$, denoted by $S^{(n)}_{m,s}$, is given by

$$
\begin{aligned}
S^{(n)}_{m,s} &= \sum_F \Omega_m \frac{2\pi}{i}\left(\frac{g\mu_B}{2\hbar}\right)^n \frac{\Pi_{k=m}^{s-1} H_k e^{i\Phi_k} H_0^{m-m_0} p_{m,s}(F)}{(-1)^{q_F} q_F! r_s(F)! \omega_0^{n-1}} \\
&\quad \times \delta^{(T)}\left(\omega_{m,s} - \sum_{k=m}^{s-1}\omega_k - (m-m_0)\omega_0\right). \qquad (11.32)
\end{aligned}
$$

The sum runs over all Feynman diagrams F. $\Omega_m = (m-m_0)!$, $q_F = m - m - r_s(F)$, $p_{m,s}(F) = \Pi_{k=m}^{s}\langle k|S_z|k\rangle^{r_k(F)}\Pi_{k=m}^{s-1}\langle k|S^-|k+1\rangle$, with $r_k(F) = 0, 1, 2, \ldots \le m - m_0$ the number of π-transitions in the transition belonging to the Feynman diagram F. $\delta^{(T)}(\omega) = 1/(2\pi)\int_{-T/2}^{T/2} \mathrm{d}t e^{i\omega T}$ is the delta-function of width T. It ensures energy conservation. For the example above, the requirement $|S^{(n)}_{m,s}| \approx |S^{(n)}_{-1,s}|$ for all $m \ge m_0$ (which corresponds to the equal superposition) is satisfied for parameters

$$
H_8/H_0 = 0.04, \qquad H_7/H_0 = -0.25, \qquad H_6/H_0 = -0.61, \qquad H_5/H_0 = -1.12. \qquad (11.33)
$$

H_9 can be chosen independently. For numerical estimates, we refer to the original paper, Ref. [27]. This concludes the discussion of generating the equal superposition required for Grover's algorithm.

With some adaptions, a single step in Grover's algorithm can be used to read-in and decode quantum information. This opens up the possibility to use molecular magnets as dense and efficient memory devices. The phases Φ_m in (11.30)–(11.31) play a crucial role here. We denote $\Phi_m = \sum_{k=s-1}^{m+1} \Phi_k + \phi_m$. As we have seen before, we can irradiate the system with a coherent magnetic pulse of duration T such that all $S_{m,s}^{(n)} = \pm\eta$. In other words, the state after the pulse is $|\psi\rangle = \sum_{m=m_0}^{s} a_m |m\rangle$, where the amplitudes $a_1 = 1$ and $a_m = \pm\eta$. By identifying the amplitude $\pm\eta$ with the logical-1, respectively logical-0, we see that this state encodes a n-bit state. Because of the Φ_m dependence of the S-matrix (see (11.32)), we can switch between the $\pm\eta$ amplitude by choosing $\phi_m = 0, \pi$. This allows us to encode a general state between 0 and $2^n - 1$ in the quantum state of the molecular magnet. The set $\{\phi_m\}$ that one uses depends on the number that has to be encoded. For instance, encoding $12_{10} = 1101_2$ requires $\phi_9 = \phi_8 = \phi_7 = 0$ and $\phi_6 = \phi_5 = \pi$. Here, the states with $m = 9, 8, 7, 6, 5$ represent respectively the binary digits $2^0, 2^1, 2^2, 2^3, 2^4$.

To decode the state of the molecule, one applies a pulse for which $S_{m_0,s}^{(n)} = S_{m_0+1,s}^{(n)} = \cdots = S_{s-1,s}^{(n)} = -\eta$. This pulse amplifies the bits which have amplitude $-\eta$, and suppresses those with amplitude η. The accumulated error in this procedure is approximately $n\eta^2$. Read-out of this decoded state can be done by measuring the occupation of the different levels by standard spectroscopy, for instance using pulsed ESR. Irradiation with a pulse which contains the frequency $\hbar\omega_{m-1,m} = \epsilon_{m-1} - \epsilon_m$ drives transitions that are given by $S_{m-1,m}^{(1)}$. If the state $|m\rangle$ is occupied (meaning that its amplitude was $-\eta$), we would observe stimulated absorption when irradiating with frequency $\omega_{6,7}$ and stimulated emission when irradiating with frequency $\omega_{7,8}$. Since the energy levels are non-equidistant, this uniquely identifies the level.

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Spin-electric Coupling in Molecular Magnets

Dimitrije Stepanenko

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Abstract. Molecular magnets behave as large spins at low energies. They show hysteresis controlled by quantum tunneling of magnetization, long spin coherence times, and spin texture in the ground state. Coupling of molecular spins to an external electric fields would provide a superior mechanism for their control and manipulation. In triangular low-spin antiferromagnets with broken inversion symmetry it is the chirality of spin texture that couples to electric fields. We show that the chirality has long coherence time, and that it allows for a controllable superradiant phase transition.

Hyperfine-induced decoherence in a triangular spin cluster varies across independent two-level subsystems that encode a qubit. Electrically controllable eigenstates of spin chirality show decoherence times that approach milliseconds, two orders of magnitude longer than those estimated for the eigenstates of the total spin projection and of the partial spin sums. The robustness of chirality is due to its decoupling from components of both the total spin and individual spins in the cluster.

A crystal of triangular molecular antiferromagnets coupled to a resonant cavity shows superradiant phase transition. The critical coupling strength for transition depends on the external magnetic field, in sharp contrast to the standard case of two-level emitters, where the critical coupling was set by the structure of emitter alone. The source of modification is traced to the entanglement of spin and chirality in the low-energy states of the cluster.

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XXXXXXXXXX and colleagues. We have now received all of the referees' reports,
which I have attached below for your information. In the light of these various
comments, we have decided to offer publication of a suitably revised version of
the manuscript. Please treat this information as strictly confidential.

Thank you again for your help and I hope that we can call upon your advice in the
future.

Yours sincerely,

Karl Ziemelis
Physical Sciences Editor, Nature
Nature's author and policy information sites are at
www.nature.com/nature/submit/.
```

Date: Mon, 4 Jun 2018 07:44:28 -0400
Message-Id: <49152811266867@ejpwww1.nature.com.nature.com>
To: dimitrije.stepanenko@ipb.ac.rs
Subject: Decision made for XXXXXXXXXX
From: Maria.Maragkou@nature.com
Reply-To: Maria.Maragkou@nature.com
X-AV-Checked: ClamAV using ClamSMTP

Dear Dr. Stepanenko,

Thank you for reviewing the manuscript "XXXXXXXXXXXXXXXX" for Nature Materials. In the light of the various comments we received, we have decided to offer publication of a suitably revised version of the manuscript. Please treat this information as strictly confidential.

Thank you again for your help and I hope that we can call upon your advice in the future.

Best wishes,

--
Maria Maragkou
Senior Editor
<i>Nature Materials</i>

Date: Wed, 4 Jan 2017 10:41:45 -0500
Message-Id: <72148354450562@ejpwww16.nature.com.nature.com>
To: dimitrije.stepanenko@ipb.ac.rs
Subject: Final Decision made for XXXXXXXX
From: scientificreports@nature.com
Reply-To: scientificreports@nature.com

Dear Dr. Stepanenko:

Thank you for your help with manuscript XXXXXXXX, "XXXXXXXXXXXXXX", which you recently reviewed for Scientific Reports.

For your records, the decision for this manuscript, based partly on your input, was Accept. A full copy of the comments to authors is appended, below.

Your assistance and participation in the review process for Scientific Reports is greatly appreciated.

Best regards,

Manuscript Administration
Scientific Reports
4 Crinan Street
London N1 9XW
E-mail: scientificreports@nature.com

Date: Mon, 18 Jun 2018 18:00:47 -0400
Message-Id: <70152935924718@buildmts-www5.nature.com.nature.com>
To: Dimitrije.Stepanenko@ipb.ac.rs
Subject: Final Decision made for XXXXXXXXX
From: npjqi@nature.com
Reply-To: npjqi@nature.com
X-AV-Checked: ClamAV using ClamSMTP

Dear colleague,

Thank you very much for reviewing the paper entitled "XXXXXXXXXXXX" for npj Quantum Information. Having considered the collective advice that we have received, the editor has taken the Revise decision. Please treat this information as strictly confidential.

For your information, the full complement of reviewers' reports is appended below, which I hope will provide some insight into the views of the other referees.

We appreciate the time you have taken to review this manuscript and submit your report. I hope that we may call upon your advice in the future.

Best regards,

Manuscript Administration
npj Quantum Information
4 Crinan Street
London N1 9XW
E-mail: npjqi@nature.com

Date: Mon, 9 Jul 2018 18:40:03 -0400
Message-ID: <1067306010.1531176003841.JavaMail.tomcat@prism-jobs-4-245>
From: prl@aps.org
Reply-To: prl@aps.org
To: dimitrije.stepanenko@ipb.ac.rs
Subject: Review_request STEPANENKO XXXXXXXXX

Re: XXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Dear Dr. Stepanenko,

We would appreciate your review of this submission to Physical Review Letters.

Please let us know promptly if you will be able to send a report and, if so, by when.

Do the authors make a convincing case for their claims?

Please address the Physical Review Letters criteria of impact, innovation, and interest in your report.

Thank you for your help.

Yours sincerely,

Robert Garisto
Editor
Physical Review Letters
Email: prl@aps.org
https://journals.aps.org/prl/
twitter @RobertGaristo

"Every 80 seconds someone cites a PRL"

Celebrating 125 Years of the Physical Review
https://journals.aps.org/125years #PhysRev125

We ask that you download the manuscript and return your report via:

https://referees.aps.org/r/XXXXXXX

Alternatively, you may send your completed Referee Response Form by email to prl@aps.org. If you use email, either reply to this message or give as the subject "Report STEPANENKO XXXXXXXXX".

...

Date: Tue, 8 May 2018 09:43:17 -0400
Message-ID: <1714919704.1525786997025.JavaMail.tomcat@prism-jobs-4-245>
From: prb@aps.org
Reply-To: prb@aps.org
To: dimitrije.stepanenko@ipb.ac.rs
Subject: Resub_review_request STEPANENKO XXXXXXXXXX

Dear Dr. Stepanenko,

We would appreciate your review of this manuscript, which has
been submitted to Physical Review B.

Comments from the editor:

XXXXXXXXXXXXXX

Thank you for your help.

Yours sincerely,

Manolis Antonoyiannakis
Associate Editor
Physical Review B
Email: prb@aps.org
http://journals.aps.org/prb/

Celebrating 125 Years of the Physical Review
https://journals.aps.org/125years #PhysRev125

We ask that you download the manuscript and return your report via:

https://referees.aps.org/r/XXXXXXXXX

Alternatively, you may send your completed Referee Response Form
by email to prb@aps.org. If you use email, either reply to this
message or give as the subject "Report STEPANENKO XXXXXXXX".

Komisija

Od školske 2015/2016. godine predsednik Državne komisije za takmičenja učenika srednjih škola iz fizike je docent dr Božidar Nikolić sa Fizičkog fakulteta u Beogradu.

Komisija za takmičenja učenika srednjih škola u školskoj 2017/2018. godini ima sledeći sastav:

Predsednik komisije:
Božidar Nikolić boza@ff.bg.ac.rs

1. razred:
Autor: Petar Mali
Autor: David Knežević
Recenzent: Milutin Stepić

2.razred:
Autor: Mihailo Čubrović
Autor: Aleksandar Bukva
Recenzent: Nikola Petrović

3.razred:
Autor: Vladan Pavlović
Autor: Ilija Ivanišević
Autor: Marko Kuzmanović
Recenzent: Dimitrije Stepanenko

4.razred:
Autor: Veljko Janković
Autor: Ana Hudomal

Autori eksperimentalnog zadatka za Srpsku fizičku olimpijadu:
Marko Opačić
Danko Bošnjaković
Milan Jocić