Научном већу Института за физику у Београду

Предмет: Покретање поступка за реизбор у звање научни сарадник

Молим Научно веће Института за физику у Београду да покрене поступак за мој реизбор у звање научни сарадник.

У прилогу достављам:

1. мишљење руководиоица лабораторије са предлогом комисије за реизбор у звање
2. биографске и стурчне податке
3. преглед научне активности
4, елементе за квалитативну анализу научног доприноса
5. елементе за квантитативну анализу научног доприноса
6. списак објављених радова
7. податке о цитираности
8. копије објављених радова
9. доказе о преосталим елементима оцена научног доприноса

С поштовањем
Михаило Чубровић

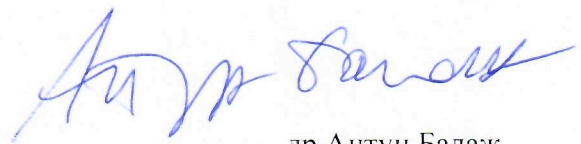**Научном већу Института за физику у Београду**

Београд, 5. мај 2022. године

Предмет: **Мишљење руководица лабораторије о реизбору др Михаила Чубровића у звање научни сарадник**

Др Михаило Чубровић је запослен у Лабораторији за примену рачунара у науци, у оквиру Националног центра изузетних вредности за изучавање комплексних система Института за физику у Београду. Он ради на темама везаним за проучавање јако корелисаних квантних система. С обзиром да испуњава све предвиђене услове у складу са Правилником о стицању истраживачких и научних звања МПНТР, сагласан сам са покретањем поступка за реизбор др Михаила Чубровића у звање научни сарадник.

За састав комисије за реизбор др Михаила Чубровића у звање научни сарадник предлажем:

(1) др Јакша Вучичевић, виши научни сарадник, Институт за физику у Београду,
(2) др Ђорђе Спасојевић, редовни професор Физичког факултета Универзитета у Београду,
(3) др Антун Балаж, научни саветник, Институт за физику у Београду

др Антун Балаж
научни саветник
Руководилац Лабораторије за примену рачунара у науци

2. Биографски и стручни подаци

Михаило Чубровић је рођен 04. 05. 1985. године у Београду, где је завршио основну школу "Деспот Стефан Лазаревић" и Математичку гимназију. Основне академске студије на Физичком факултету, смер Теоријска и експериментална физика, завршио је 2008. године са просечном оценом 9,85. Дипломски рад на тему „On topological defects in quantum and classical glass systems" („О тополошким дефектима у класичним и квантним стакленим системима") урадио је под менторством др Милана Петровића, научног саветника Института за физику у Београду. Од 2003. године до завршетка студија је био стипендиста Министарства за науку.

По завршетку академских студија, уписао је докторске студије из области физике на Лоренцовом институту Универзитета у Лајдену, Холандија. Докторску дисертацију на тему „Holography, Fermi surfaces and criticality" („Холографија, Фермијеве површи и критичност") урадио је под менторством др Јана Занена (Jan Zaanen) и др Кунрада Схалма (Koenraad Schalm), а одбранио је у фебруару 2013. године. Диплома докторских студија је нострификована јануара 2017. године, решењем Министарства просвете, науке и технолошког развоја бр. 612-01- 02635/2016-06. У току докторских студија био је запослен као млађи истраживач на Лоренцовом институту, и као асистент у настави на Универзитету у Лајдену.

По завршетку доктората, био је постдок на Универзитету у Келну, у групи др Ахима Роша (Achim Rosch). У току постдокторског усавршавања био је такође запослен као асистент у настави. Од 2017. године ради на Институту за физику у Београду, у Центру за изучавање комплексних система.

Од јула 2020. године учесник је пројекта "Cold atoms, Hubbard model and holography: the key to strange metals" (Key2SM) Фонда за финансирање науке Републике Србије. Током докторских студија био је добитник награде "Trots op" за научни рад на Универзитету у Лајдену.

Учествовао је и презентовао своје резултате на више конференција и радионица. Објавио је 14 публикација, од тога један рад у престижном часопису Science (класификован као "Highly cited paper" у бази података Web of Science). Укупно је објавио 2 рада у часописима категорије М21а, 11 радова у часописима категорије М21, 1 рад у часопису категорије М22 и једно поглавље у зборнику водећег међународног значаја М13. Његови радови су у другим радовима цитирани укупно 419 пута без самоцитата, а Хиршов индекс износи 5 (подаци узети са базе WoS 19. маја 2022).

3. Преглед научне активности

Научно-истраживачки рад др Михаила Чубровића је фокусиран на тромеђу јако корелисаних квантних многочестичних система, физике високих енергија и нелинеарне динамике. У првој од наведених тема, кандидат се интересује пре свега за не-Фермијеве течности, чудне метале и квантно-критичне фазе, физика високих енергија се појављује кроз AdS/CFT кореспонденцију (холографију, холографску дуалност), термодинамику и информационе проблеме црних рупа, а нелинеарна динамика с једне стране даје игралиште за симулирање јако корелисаних система и квантне критичности, а с друге стране је тесно везана за проблеме информације црних рупа, и квантне сплетености (quantum entanglement) чудних метала. Радови кандидата комбинују аналитичке (теоријске) и нумеричке методе.

Основно питање радова [A1,B2-B4] је: можемо ли разумети не-Фермијеве течности и чудне метале на нивоу теорије средњег поља аналогне Ландауовој теорији Фермијевих течности, те постоји ли генеричко (РГ стабилно) стање интерагујућих електрона, које не нарушава никакву симетрију а које се разликује од Фермијеве течности. Идеја је да се проблем формулише преко AdS/CFT кореспонденције (холографског принципа), дуалности између отворених и затворених струна откривене крајем деведесетих година прошлога века. Дуалност повезује теорију поља (строго узев, геју теорију) са интеракцијама реда величине g са гравитацијом у анти-де Ситеровом простору са гравитационом константом реда 1/g. Тако јако корелисани системи одговарају слабо интерагујућој, квазикласичној гравитацији. Први покушај [A1] је показао да већ јако упрошћен модел, који одговара електронима ниске густине у интеракцији са (неидентификованом) јако интерагујућом геју теоријом, показује Фермијеве површи са стабилним квазичестицама, сличним Фермијевој течности. Рад [B2] доноси целовитију теорију, у којој се показује да систем има две фазе, од којих једна одговара Фермијевој течности, а друга не-Фермијевој течности са неким квантно-критичним особинама (аномално скалирање по енергији, не и по импулсу). Овде је изведен нови елемент "холографског речника", тј. нови елемент AdS/CFT дуалности: скок дистрибуције импулса на Фермијевој површи Z одговара одређеној одржаној струји (билинеарном оператору) у AdS простору; разрађен је и општи формализам за рачун са билинеарним операторима који се може употребити и за друге параметре уређења. У [B3,B4] се разматрају пре свега формална питања значајна за разумевање саме кореспонденције: испоставља се да је нестабилност критичне Фермијеве површи дуална суперрадијационој нестабилности наелектрисане црне рупе, док Фермијева течност одговара Лифшицовој геометрији. На основу тога, у [B4] је конструисан цео фазни дијаграм система. Методолошки, ови радови комбинују аналитичка извођења на основу "холографског речника", тј. асимптотских решења Ајнштајнових једначина која се могу добити аналитички, и самоусаглашено нумеричко решавање целог система једначина (за метрику, геју поља и поља материје) у AdS простору. Сада кандидат сличним методама проучава не-Фермијеве течности у присуству кристалне решетке, слично као у Хабардовом моделу. Други активни правац рада (arXiv:2204.10092[hep-th]) је моделирање стабилне Фермијеве течности, што је у холографском приступу сложеније него добијање не-Фермијеве течности.

У радовима [B1,B6] такође су у холографским моделима проучавани јако интерагујући електрони, али сада у спољашњем магнетном пољу. У [B1] је дат крајње поједностављен модел квантног Холовог ефекта и фактори попуњености у фази Фермијеве и не-Фермијеве течности. Показује се да у овом моделу не-Фермијева фаза доводи до фракционе попуњености, док нормални метал даје целобројни ефекат. У [B76 је дат физички боље мотивисан модел екситона (парова електрон-шупљина) у билинеарном формализму претходно развијеном у [B2]. Показано је како долази до магнетне катализе и кондензације екситона под дејством магнетног поља, и

конструисан је фазни дијаграм који је упоређен са резултатима из литературе за екситоне у двослојном графену. Овај рад ће бити искоришћен као основа за реалистичније моделе спаривања електрон-шупљина, какви се јављају у експериментално реализованим системима диполних фермиона и двослојева.

Док холографски модели чудних метала и не-Фермијевих течности представљају у извесном смислу квантне критичне фазе (јер имају степене законе скалирања не у једној тачки, већ у читавој области простора), што их чини занимљивим и повезује са неким експерименталним резултатима, с друге стране у јако корелисаним системима квантне критичне тачке могу такође да се разликују од уобичајене парадигме фазних прелаза између уређених и неуређених фаза. У [B7] је показано како холографски суперпроводници могу имати критичну тачку у којој истовремено долази и до кондензације електронских парова и до деконфинирања позадинских U(N) гејџ поља. Сличне ситуације у којима се комбинују сламање симетрије и деконфинирање пронађене су и у [B8,B9] на примеру вртлога у нелинеарном оптичком систему. Ту деконфинирање одговара прелазу Березинског-Костерлиц-Таулеса (БКТ), који се види и у холографским системима, а симетрије могу бити геометријске, као у [B8], или сложеније, везане за колективно понашање, као у [B9]. Овакве ситуације су познате и у литератури о егзотичном магнетизму и Сачдев-Је-Китаев (Sachdev-Ye-Kitaev) моделима, а предност класичних модела које смо користили је да су добрим делом доступни и аналитичком раду.

Коначно, можемо се упитати да ли постоји и непосредна веза нелинеарне динамике и неких универзалних, квантно-критичних особина многочестичних система. Чини се да потврдан одговор дају границе хаоса, тј. максималне вредности квантног Љапуновљевог експонента нађене за класичне црне рупе и њихове холографске дуале. У раду [B10] кандидат је показао да границе хаоса имају важну улогу са обе стране холографске дуалности, али се модификују у присуству квантних објеката као што струне (тј. у присуству корекција на класичну општу релативност); у дуалној теорији поља ово значи да посматрамо композитне операторе велике димензије. У раду [B11] овај налаз је знатно уопштен: чим димензије оператора не чине дискретан спектар као у конформним теоријама поља (што се односи на већину практичних ситуација, осим уобичајених квантних критичних тачака – не и квантних критичних фаза), квантни Љапуновљеви експоненти губе смисао, и мора се посматрати цела временски неуређена корелациона функција. Њено понашање је међутим универзално, и показује два робусна режима, који разликују чисто хаотичну од мешане динамике. Док је у класичном хаосу овакве системе могуће разликовати нпр. путем Поенкареових пресека, до сада није било начина да се мешана динамика јасно детектује у квантом случају (осим путем статистике енергетског спектра, што је захтева знатно обимније прорачуне). У току је такође рад на статистичким карактеристикама квантно-хаотичних система (arXiv:2203.10697[hep-th]) и на телепортацији у високо корелисаним и квантно-хаотичним системима (arXiv:2103.01372[hep-th]).

4. Елементи за квалитативну анализу научног доприноса

4.1 Квалитет научних резултата

Кандидат је до сада објавио 14 радова, од тога 2 у часопиима категорије М21а (међународни часопис изузетне вредности), 11 у часописима категорије М21 (врхунски међународни часопис) и 1 у часопису категорије М22 (водећи међународни часопис).

4.1.1 Научни ниво и значај резултата

Радови кандидата највећим делом (13 од 14 радова) су објављени у врхунским међународним часописима. Радови [А1], [В2] и [В3] формирали су нову тачку гледишта на високко корелисане фермионе и инспирисали даљи рад низа аутора у истом правцу. Рад [В10] је указао на дубоке везе теорије струна и квантног хаоса и недавно је такође инспирисао даљи рад других аутора у покушају да разумеју везу динамике струне и временски неуређених корелационих функција у теорији поља.

4.1.2 Цитираност научних радова кандидата

Према бази Web of Science, радови кандидата су цитирани укупно 419 пута без самоцитата (times cited without self-citations), у укупно 370 радова (citing articles witohut self-citations), уз Хиршов индекс 5.

4.1.3 Параметри квалитета радова и часописа

Кандидат је објавио радове у следећим часописима:

1 рад у Science (ИФ(2009)=29.747, СНИП(2009)=7.04)
5 радова у Journal of High Energy Physics (ИФ(2010)=6.049, ИФ(2013)=6.220, ИФ(2014)=6.110, ИФ(2019)=5.875, ИФ(2020)=5.810, СНИП(2011)=1.42, СНИП(2016)=1.35, СНИП(2020)=1.17)
2 рада у Physical Review A (ИФ(2016)=2.925, ИФ(2017)=2.909, СНИП(2015)=1.07, СНИП(2017)=1.02)
1 рад у Physical Review B (ИФ(2014)=3.736, СНИП(2013)=1.32) (ИФ=3.718)
3 рада у Physical Review D (ИФ(2010)=4.964, ИФ(2013)=4.864, СНИП(2009)=1.66, СНИП(2011)=1.52, СНИП(2013)=1.41)
1 рад у Physical Review E (ИФ(2005)=2.418, СНИП(2003)=1.16)
1 рад у European Physical Journal D (ИФ(2007)=1.828, СНИП(2007)=0.89)
Укупан импакт фактор радова кандидата је 88.32.

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

Кандидат је једини аутор радова [А1,В7,В10]. Кандидат је водећи аутор на 5 радова са коауторима [А2,В2,В3,В8,С1], у којима је развио нумерички метод и дао кључни допринос у погледу израде нумеричких симулација и њихове интерпретације, као и допринос писању радова. На радовима [В1,В6,Д1] кандидат је аутор нумеричког метода коришћеног за добијање резултата. Радови [В9] и [В11] настали су као резултат студентских пракси, први аутори су студенти Драган Марковић и Тривко Кукољ, а кандидат, као руководилац истраживања, је други аутор.

4.2 Ангажованост у формирању научних кадрова

Активности пре претходног избора у звање

Кандидат је у летњем семестру 2010. и 2011. године био асистент на предмету Theory of Condensed Matter на Универзитету у Лајдену. На Универзитету у Келну био је асистент на предметима Advanced Quantum Mechanics (зима 2013. године), Quantum Mechanics (лето 2014. године) и Quantum Field Theory (лето 2015. године). На универзитету у Лајдену кандидат је радио са мастер студентима (Piet Schijven и Jelle Brill), који су се укључили у рад на публикацијама [B1] и [D1].

Активности након претходног избора у звање

Михаило Чубровић је тренутно ментор мастер тезе студента Владана Гецина (Физички факултет у Београду), на тему холографског Хабардовог модела у оквиру пројекта Key2SM (студент није члан Key2SM тима, али сарађује на истој теми). Студент ће бранити тезу у јулу или септембру 2022. године.

Кандидат је радио са студентима Физичког факултета у Београду и Природно-математичког факултета у Новом Саду у оквиру летњих пракси. Летњу праксу са кандидатом су радили Душан Новичић (аналитичко тражење солитонских решења методом инверзног расејања, 2017; хаотичне геодезијске у пољу длакаве црне рупе, 2018), Владан Ђукић (Emerging Fermi liquids from regulated Quantum Electron Stars, 2022) и Драган Марковић [B11], сви са Физичког факултета у Београду; Тривко Кукољ [B9] и Филип Херчек (електронски спектри на холографским решеткама, у оквиру пројекта Key2SM), сви са Природно-математичког факултета у Новом Саду. Током посет Универзитету у Лајдену (и раније Универзитету у Амстердаму), кандидат ради са студентом Николом Шањеом (Nicolas Chagnet), на заједничком пројекту са Владаном Ђукићем (Emerging Fermi liquids from regulated Quantum Electron Stars, 2022, arXiv:2204.10092[hep-th]).

Кандидат је такође држао предавања у оквиру предмета Семинар савремене физике за студенте треће године Физичког факултета у Београду (теме: Квантна критичност и чудни метали, март 2018 и април 2019; Квантна теорија информација, црне рупе и црвоточине, април 2021). Такође је активан као стручни сарадник у Истраживачкој станици Петница, на семинарима Астрономија и Физика.

4.3 Нормирање броја коауторских радова, патената и техничких решења

Сви радови кандидата укључују нумеричке симулације. Сви радови кандидата у изборном периоду су са 2 или мање аутора, па се рачунају са пуним бројем бодова. Укупан број M бодова је 35 (од тога 32 на основу радова из категорија M20).

4.4 Учешће у пројектима, потпројектима и пројектним задацима

Кандидат је учествовао у пројекту ON171017 финансираном од стране Министарства за науку, просвету и технолошки развој. Био је руководилац потпројекта 3, Јако корелисани многочестични системи, AdS/CFT кореспонденција и квантна критичност, у оквиру Лабораторије за примену рачунара у науци Центра изузетних вредности за изучавање комплексних система Института за физику у Београду, а учествовао је и у потпројекту 2,

"Тополошке фазе" истог центра.

Током последње две године, главни фокус научне активности кандидата представља пројекат ПРОМИС Центра за финансирање науке Републике Србије под називом "Cold atoms, Hubbard model and holography: the key to strange metals (Key2SM). Пројекат има за циљ да испита могуће везе AdS/CFT модела чудних метала (базираних на црним рупама које нарушавају законе хиперскалирања у Ајнштајн-Максвел-дилатон системима) и Хабардовог модела, путем поређења спектралних функција електрона.

4.5 Активност у научним и научно-стручним друштвима

4.5.1 Рецензије научних радова

Кандидат је рецензент у часописима Journal of High Energy Physics (ИФ=5.810) и European Physical Journal C (ИФ=4.590).

4.5.2 Организација научних скупова

Кандидат је коорганизатор online радионице "Strange metal in the Hubbard model and AdS/CFT" која ће се одржати 23-25. маја ове године, у оквиру PROMIS пројекта Key2SM. Радионица ће окупити водеће експерте из двеју области које проучавају јако корелисане електронске системе двема различитим методама: нумеричким решавањем Хабардовог модела и дуалношћу AdS/CFT. Кандидат ће на овом скупу и презентовати своје најновије резултате.

4.6 Утицајност научних резултата

Кандидат је у току докторских студија развио методе рачунања спектра и проучавања основног стања (путем бекреакције на геометрију) за холографске моделе на коначној густини (или хемијском потенцијалу). Ови методи и резултати су покренули рад низа истраживача на сличним питањима, што се види из цитираности кључних радова, пре свега [A1] и [B2,B3], а такође су иницирали систематски рад на холографском приступу јако корелисаним електронским системима на Универзитету у Лајдену. Кандидат је иницирао рад на примењеној холографији као новој области на Институту за физику, руководио одговарајућим потпројектом у оквиру пројекта OH170717, и иницирао повезивање ове области са добро потврђеним микроскопским моделима као што је Хабардов, поређењем са квантним Монте Карло прорачунима.

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

Као што је већ наведено, кандидат је самостални аутор 3 рада, водећи аутор 5 радова, аутор кода за нумеричке симулације у још 3 рада и руководилац студента на пракси и докторског студента на 2 рада. Већину својих научних активности после претходног избора у звање кандидат обавља на Институту за физику у Београду, уз редовне посете Универзитету у Лајдену.

4.8 Међународна сарадња

Кандидат је завршио докторске студије на Универзитету у Лајдену, са којим и данас има активну сарадњу. Након тога, био је на постдокторском усавршавању на Универзитету у Келну. Кандидат је сарађивао и са Универзитетом у Франкфурту (Institute for Theoretical Physics, J.-W. Goethe-

University), Институтом за напредне студије у Франкфурту (Frankfurt Institute for Advanced Studies), Универзитетом у Гетингену (Institute for Theoretical Physics, Georg August University, Goettingen) и Универзитетом у Амстердаму, што се види из радова са коауторима. Остварио је краће посете бројним универзизетима и институтима (Уиверзитет у Утрехту; NORDITA, Стокхолм; Природно-математички факултет Љубљана (online)) где је на семинарима представио своје радове.

5. Елементи за квантитативну анализу научног доприноса

Остварени резултати у периоду након одлуке Научног већа о предлогу за стицање претходног научног звања:

Категорија	М бодова по раду	Број радова	Укупно М бодова	Нормирани број М бодова
М21	8	4	32	32
М33	1	2	2	2
М34	0.5	2	1	1
укупно				35

Поређење са минималним квантитативним резултатима за избор у звање научни сарадник:

М категорије	Минимални услов	Нормирани остварени резултат
Укупно	16	35
М10+М20+М31+М32+М33+М41+М42	10	35
М11+М12+М21+М22+М23	6	32

6. Списак објављених радова

Радови објављени у научним часописима међународног значаја (М20)

Радови у међународним часописима изузетних вредности (М21а)

Радови објављени пре претходног избора у звање

[A1]
M. Čubrović
Fractional kinetic model for chaotic transport in nonintegrable Hamiltonian systems,
Physical Review E 72, 025204(R) (2005)
10.1103/PhysRevE.72.025204
цитиран 1 пут, ИФ за 2005. годину 2.418 (М21а)

Радови објављени након претходног избора у звање

[A2]
M. Čubrović, J. Zaanen, K. Schalm
String theory, quantum phase transitions and the emergent Fermi liquid,
Science 325, 439 (2009)
[arXiv:0904.1993[hep-th]]
10.126/science.1174962
цитиран 344 пута, ИФ за 2009. годину 29.747 (М21а)

Радови у врхунским међународним часописима (М21)

Радови објављени пре претходног избора у звање

[B1]
E. Gubankova, J. Brill, M. Čubrović, K. Schalm, P. Schijven, J. Zaanen
Holographic fermions in external magnetic fields,
Physical Review D 84, 106003 (2011)
[arXiv:1011.4051[hep-th]]
https://doi.org/10.1103/PhysRevD.84.106003
цитиран 18 пута, ИФ за 2010. годину 4.964 (М21)

[B2]
M. Čubrović, J. Zaanen, K. Schalm
Constructing the AdS dual of a Fermi liquid: black holes with Dirac hair,
Journal of High Energy Physics 10, 2011, 17, (2011)
[arXiv:1012.5681[hep-th]]
https://doi.org/10.1007/JHEP10(2011)017
цитиран 21 пут, ИФ за 2010. годину 6.049 (М21)

[B3]
M. Čubrović, Y. Liu, K. Schalm, Y.-W. Sun, J. Zaanen
Spectral probes of the holographic Fermi liquid ground state: Dialing between the electron star and the AdS Dirac hair,

Physical Review D, 84, 086002 (2013)
[arXiv:1106.1798[hep-th]]
https://doi.org/10.1103/PhysRevD.84.086002
цитиран 27 пута, ИФ за 2013. годину 4.864 (M21)

[B4]
M. V. Medvedyeva, E. Gubankova, M. Čubrović, K. Schalm, J. Zaanen
Quantum corrected phase diagram of holographic fermions,
Journal of High Energy Physics 12, 2013, 25 (2013)
[arXiv:1302.5149[hep-th]]
https://doi.org/10.1007/JHEP12(2013)025 (M21)
цитиран 5 пута, ИФ за 2013. годину 6.220 (M21)

[B5]
M. V. Medvedyeva, M. T. Čubrović, S. Kehrein
Dissipation-induced first-order decoherence phase transition in a noninteracting fermionic system,
Physical Review B 91, 205416 (2015)
[arXiv:1409.1625[cond-mat]]
https://doi.org/10.1103/PhysRevB.91.205416
цитиран 4 пута, ИФ за 2014. годину 3.736 (M21)

[B6]
E. Gubankova, M. Čubrović, J. Zaanen
Exciton-driven quantum phase transitions in holography,
Physical Review D 92, 086004 (2015)
[arXiv:1412.2373[hep-th]]
https://doi.org/10.1103/PhysRevD.92.086004
цитиран 5 пута, ИФ за 2013. годину 4.864 (M21)

[B7]
M. Čubrović
Confinement/deconfinement transition from symmetry breaking in gauge/gravity duality,
Journal of High Energy Physics 10, 2016, 102 (2016)
[arXiv:1605.07849[hep-th]]
https://doi.org/10.1007/JHEP10(2016)102
цитиран 2 пута, ИФ за 2014. годину 6.111 (M21)

Радови објављени након претходног избора у звање

[B8]
M. Čubrović and M. S. Petrović
Quantum criticality in photorefractive optics: Vortices in laser beams and antiferromagnets,
Physical Review A, 96, 053824 (2017)
[arXiv:1701.03451[physics.optics]]
https://doi.org/10.1103/PhysRevA.96.053824
цитиран 2 пута, ИФ за 2016. годину 2.925 (M21)

[B9]
T. Kukolj and M. Čubrović

Spontaneous isotropy breaking for vortices in nonlinear left-handed metamaterials,
Physical Review A, 100, 053853 (2019)
[arXiv:1812.08805[physics.optics]]
https://doi.org/10.1103/PhysRevA.100.053853
15 страна, ИФ за 2017. годину 2.909 (М21)

[B10]
M. Čubrović
The bound on chaos for closed strings in Anti-de Sitter black hole backgrounds,
Journal of High Energy Physics 12, 2019, 150 (2019)
[arXiv:1904.06295[hep-th]]
https://doi.org/10.1007/JHEP12(2019)150
цитиран 7 пута, ИФ за 2019. годину 5.875 (М21)

[B11]
D. Marković and M. Čubrović
Detecting few-body quantum chaos: out-of-time ordered correlators at saturation
Journal of High Energy Physics 05, 2022, 023 (2022)
[arXiv:2202.09443[hep-th]]
ИФ за 2020. годину 5.810 (М21)

Радови у водећим међународним часописима (М22)

Радови објављени пре претходног избора у звање

[C1]
M. Čubrović, O. Obolensky, A. Solov'yov
Semistiff polymer model of unfolded proteins and its application to NMR residual dipolar couplings,
European Physical Journal D 51, 41 (2009)
https://doi.org/10.1140/epjd/e2008-00195-x
цитиран 5 пута, ИФ за 2007. годину 1.828 (М22)

Радови у тематском зборнику водећег међународног значаја (М13)

Радови објављени пре претходног избора у звање

[D1]
E. Gubankova, J. Brill, M. Čubrović, K. Schalm, P. Schijven, J. Zaanen
Holographic description of strongly correlated electrons in external magnetic fields
D. Kharzeev et al (eds.), Strongly interacting matter in magnetic fields, Lecture Notes in Physics 871, Springer-Verlag Berlin Heidelberg, 2013. (ISBN 978-3-642-37304-6), p. 555.
35 страна

Зборници међународних научних скупова (М30)

Саопштења са међународних скупова штампана у целини (М33)

Радови објављени пре претходног избора у звање

[E1]
M. Čubrović
Regimes of stability and scaling relations for the removal time in the asteroid belt: a simple kinetic model and numerical tests
(Z. Knežević, A. Milani, eds.), IAUC197 2004, 209, 2004.
IAU Colloquium No. 197: „Dynamics of Populations of Planetary Systems", Belgrade, Serbia, September 1-5. 2004
8 страна

[E2]
M. Čubrović
Fully analytic kinetic model of resonance dynamics in the Solar system, Publ. Astron. Obs. Belgrade 80, 173, 2006.
Proceedings of the XIV National conference of astronomers of Serbia and Montenegro
5 страна

Радови објављени након претходног избора у звање

[E3]
M. Čubrović and M. Petrović
Vortex dynamics of counterpropagting laser beams in photorefractive materials, Optical and Quantum Electronics 50, 406, 2018.
VI International School and Conference on Photonics – PHOTONICA2017, Belgrade, 28 August -1 September 2017.
http://www.photonica.ipb.ac.rs/2017
13 страна

[E4]
M. Čubrović
Fermions, hairy black holes and hairy wormholes in anti-de Sitter spaces
SFIN year XXXIII Series A: Conferences, No. A1, 59, (2020)
Proceedings of the 10th MATHEMATICAL PHYSICS MEETING: School and Conference on Modern Mathematical Physics, Belgrade 9-14 September 2019.
http://www.mphys10.ipb.ac.rs
28 страна

Саопштења са међународних скупова штампана у изводима (М34)

Радови објављени пре претходног избора у звање

[F1]
M. Čubrović
Universality and scaling in nonlinear Hamiltonian systems – escape times, Lyapunov exponents and

inverse chaotic scattering.
Let's Face Chaos Through Nonlinear Dynamics, Maribor, Slovenia, June 26. – July 10. 2005.

[F2]
M. Čubrović, J. Zaanen, K. Schalm
Geometry encoding for statistics: from Fermi liquids to Cooper pairing.
Physics@FOM 2011, Veldhoven, Netherlands, January 18-20. 2011.

[F3]
M. Čubrović, K. Schalm, J. Zaanen
Fermionic quantum criticality from AdS/CFT correspondence.
SFKM2011 – Symposium on Physics of Condensed Matter, Belgrade, Serbia, April 2011.

[F4]
M. Čubrović, K. Schalm, J. Zaanen
Novel stable phases of matter from AdS/CFT correspondence.
Physics@FOM 2012, Veldhoven, Netherlands, January 17-19. 2012.

[F5]
M. Čubrović, J. Zaanen, K. Schalm
The strange metals and Fermi liquids of holography.
Physics@FOM 2013, Veldhoven, Netherlands, January 22-24. 2013.

[F6]
M. Čubrović
Heavy fermion quantum critical point from AdS/CFT correspondence.
DPG spring meeting, Dresden, Germany, March 30-April 4 2014.

[F7]
M. Čubrović
Dissipation-induced first order decoherence phase transition in a non-interacting fermionic system.
DPG spring meeting, Berlin, Germany, March 15-20 2015.

Радови објављени након претходног избора у звање

[F8]
M. Čubrović
Lyapunov spectra in traversable wormholes and their holographic duals.
Iberian Strings II-3, Lisboa, Portugal, January 19-22 2021 (online)
https://ibstrings2021.math.tecnico.ulisboa.pt

[F9]
M. Čubrović
Chaos and replica wormholes in the IIB matrix model, 素粒子論研究 (Research in high-energy physics) 36, 2022.
YITP workshop Strings and Fields 2021, YITP, Kyoto, 23-27 August (online)
http://www2.yukawa.kyoto-u.ac.jp/~qft.web/2021

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Spontaneous isotropy breaking for vortices in nonlinear left-handed metamaterials
Kukolj, Trivko and Cubrovic, Mihailo
Published 2019 | PHYSICAL REVIEW A

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Vortex dynamics of counterpropagating laser beams in photorefractive materials
Cubrovic, Mihailo and Petrovic, Milan
Published 2018 | OPTICAL AND QUANTUM ELECTRONICS

0 Times Cited

Quantum criticality in photorefractive optics: Vortices in laser beams and antiferromagnets
Cubrovic, Mihailo and Petrovic, Milan S.
Published 2017 | PHYSICAL REVIEW A

2 Times Cited

Confinement/deconfinement transition from symmetry breaking in gauge/gravity duality
Cubrovic, Mihailo
Published 2016 | JOURNAL OF HIGH ENERGY PHYSICS

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Exciton-driven quantum phase transitions in holography
Gubankova, E. ; Cubrovic, M. ; Zaanen, J.
Published 2015 | PHYSICAL REVIEW D

5 Times Cited

Dissipation-induced first-order decoherence phase transition in a noninteracting fermionic system
Medvedyeva, M. V. ; Cubrovic, M. T. ; Kehrein, S.
Published 2015 | PHYSICAL REVIEW B

4 Times Cited

Quantum corrected phase diagram of holographic fermions
Medvedyeva, Mariya V. ; Gubankova, Elena ; (...); Zaanen, Jan
Published 2013 | JOURNAL OF HIGH ENERGY PHYSICS

5 Times Cited

Holographic fermions in external magnetic fields
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Yakubovich, AV and Solov'yov, AV
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Intrinsically disordered proteins (IDPs) have been shown to be involved in a number of cellular functions, in addition to their predominance in diseased states. alpha-Synuclein may be described as one such IDP, implicated in the pathology of Parkinson's disease. Understanding the conformational characteristics of the monomeric state of alpha-synuclein is necessary for understanding the role of   … Show more

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We present a statistical mechanics formalism for the theoretical description of the process of protein folding <-> unfolding transition in water environment. The presented formalism is based on the construction of the partition function of a protein obeying two-stage-like folding kinetics. Than, using the statistical mechanics model of solvation of hydrophobic hydrocarbons we obtain the partiti   … Show more

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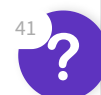
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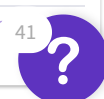
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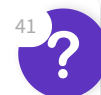
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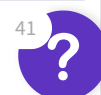
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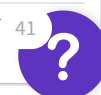Full Text at Publisher

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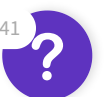*337 records matched your query of the 54,227,984 in the data limits you selected.*

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Feb 2021 | Feb 2021 (Early Access) | JETP LETTERS 113 (4) , pp.285-288

In this paper we consider holographic model of exciton condensation in double monolayer Dirac semimetal. Exciton is bound states of an electron and a hole. Being Bose particles, excitons can form a Bose-Einstein condensate. We study formation of two types of condensates. In first case both the electron and the hole forming the exciton are in the same layer (intralayer condensate), in the second　　… Show more

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Based on the gauge/gravity correspondence we have calculated the thermoelectric kinetic and transport characteristics of the strongly interacting materials in the presence of perpendicular magnetic field. The 3+1 dimensional system with Dirac-like spectrum is considered as a strongly interacting one if it is close to the particle-hole symmetry point. Transport in such system has been modeled by　　… Show more

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We build a holographic model for the pairing fluctuation pseudogap phase in fermionic high temperature superconductivity/ superfluidity based on the BCS-BEC crossover scenario. The pseudogap originates from incoherent Cooper pairing and has been observed in recent cold atom experiments. The strength of Cooper pairing and hence the BCS-BEC crossover is controlled by an effective 4-Fermi interact　　… Show more

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We consider the generalization of the S-duality transformation previously investigated in the context of the fractional quantum Hall effect (FQHE) and s-wave superconductivity to p-wave superconductivity in 2 + 1 dimensions in the framework of the AdS/CFT correspondence. The vector Cooper condensate transforms under the S-duality action to the pseudovector condensate at the dual side. The 3 + 1　　… Show more

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Zollner, R and Kampfer, B
Mar 16 2020 | EUROPEAN PHYSICAL JOURNAL PLUS 135 (3)

Asymptotic AdS Riemann space-times in five dimensions with a black brane (horizon) sourced by a fully back-reacted scalar field (dilaton) offer-via the holographic dictionary-various options for the thermodynamics of the flat four-dimensional boundary theory, uncovering Hawking-Page, first-order, and second-order phase transitions up to a cross-over or featureless behavior. The relation of thes　　… Show more

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We examine the onset of superfluid instabilities for geometries that exhibit hyperscaling violation and Lifshitz-like scaling at infrared and intermediate energy scales, and approach AdS in the ultraviolet. In particular, we are interested in the role of a non-trivial coupling between the neutral scalar supporting the scaling regime, and the (charged) complex scalar which condenses. The analysi　　… Show more

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We explore numerically and analytically the pattern formation and symmetry breaking of beams propagating through left-handed (negative) nonlinear metamaterials. When the input beam is a vortex with topological charge (winding number) Q, the initially circular (isotropic) beam acquires the symmetry of a polygon with Q, 2Q, or 3Q sides, depending on the details of the response functions of the ma   … Show more

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Nov 2018 | OPTICAL AND QUANTUM ELECTRONICS 50 (11)

We study vortex patterns of counterpropagating laser beams in a photorefractive crystal, with or without the background photonic lattice. The vortices are effectively planar and have two "flavors" because there are two opposite directions of beam propagation. In a certain parameter range, the vortices form stable equilibrium configurations which we study using the methods of statistical field t   … Show more

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☐ 1   **Chaotic Motion near Black Hole and Cosmological Horizons**
🔓 🕐   Giataganas, D
Jan 2022 | Jan 2022 (Early Access) | FORTSCHRITTE DER PHYSIK-PROGRESS OF PHYSICS 70 (1)
It is known that certain types of particle motion near black hole horizons are chaotic while it has been proposed the existence of a universal bound for their Lyapunov exponent. We discuss the relation between chaos and inaffinity in presence of black hole and cosmological horizons. We argue that although a relation between the Lyapunov exponent and the generalized surface gravity appears natur   … Show more
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☐ 2   **Bound on the Lyapunov exponent in Kerr-Newman black holes via a charged particle**
🔓   Kan, N and Gwak, B
Jan 6 2022 | PHYSICAL REVIEW D 105 (2)
We investigate the conjecture on the upper bound of the Lyapunov exponent for the chaotic motion of a charged particle around a Kerr-Newman black hole. The Lyapunov exponent is closely associated with the maximum of the effective potential with respect to the particle. We show that when the angular momenta of the black hole and particle are considered, the Lyapunov exponent can exceed the conje   … Show more
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☐ 3   **Minimal length effects on motion of a particle in Rindler space**
🔓   Guo, XB; Liang, KK; (…); Yang, MT
Feb 2021 | CHINESE PHYSICS C 45 (2)
⊟ Enriched Cited References
Various quantum theories of gravity predict the existence of a minimal measurable length. In this paper, we study effects of the minimal length on the motion of a particle in the Rindler space under a harmonic potential. This toy model captures key features of particle dynamics near a black hole horizon and allows us to make three observations. First, we find that chaotic behavior becomes stron   … Show more
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☐ 4   **Near-horizon local instability and quantum thermality**
🔓   Dalui, S and Majhi, BR
Dec 21 2020 | PHYSICAL REVIEW D 102 (12)
We revisit our previous proposed conjecture-the horizon creates a local instability which acts as the source of the quantum temperature of a black hole. It is found that a chargeless massless particle moving along the null trajectory in Eddington-Finkelstein (EF) coordinates feels instability in the vicinity of the horizon. Such instability is observer independent for this particle motion. More   … Show more
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☐ 5   **Horizon induces instability locally and creates quantum thermality**
🔓   Dalui, S; Majhi, BR and Mishra, P
Aug 5 2020 | PHYSICAL REVIEW D 102 (4)
The classical Hamiltonian for a chargeless and massless particle in a very near-horizon region is shown to be of the form H similar to xp as long as radial motion is concerned. This is demonstrated explicitly for static spherically symmetric black hole and also found to be applicable for specific choice of radial trajectories in the Kerr case. Such feature of horizon leads to unavoidable "local   … Show more
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☐ 6   **Chaotic dynamics of string around charged black brane with hyperscaling violation**
🔓   Ma, DZ; Zhang, D; (…); Wu, JP
Jan 17 2020 | JOURNAL OF HIGH ENERGY PHYSICS (1)
By fast Lyapunov indicator (FLI), we study the chaotic dynamics of closed string around charged black brane with hyperscaling violation (HV). The Hawking temperature, Lifshitz dynamical exponent and HV exponent together affect the chaotic dynamics of this system. The temperature plays the role of driving the closed string to escape to infinity. There is a threshold value $z^* = 2$, below which the   … Show more
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Република Србија
**МИНИСТАРСТВО ПРОСВЕТЕ,
НАУКЕ И ТЕХНОЛОШКОГ РАЗВОЈА**
Број: 612-01-02635/2016-06
Датум:09.01.2017. године
Немањина 22-26
Б е о г р а д
ЈК

На основу члана 105б. став 4. Закона о високом образовању („Службени гласник РС", бр. 76/05, аутентично тумачење – 100/07, 97/08, 44/10, 93/12, 89/13, 99/14, 45/15 – аутентично тумачење и 68/15), члана 192. став 1. Закона о општем управном поступку („Службени гласник СРЈ", бр. 33/97 и 31/01, „Службени гласник РС", број 30/10) и члана 23. став 2. Закона о државној управи („Службени гласник РС", бр. 79/05, 101/07, 95/10 и 99/14), решавајући по захтеву Михаила Чубровића из Београда, Република Србија, за признавање високошколске исправе издате у Краљевини Холандији, ради запошљавања,

министар просвете, науке и технолошког развоја доноси

Р Е Ш Е Њ Е

Диплома коју је 27.02.2013. године на име Михаило Чубровић издао Универзитет у Лајдену (Universiteit Leiden), Лајден, Краљевина Холандија, о завршеним докторским академским студијама, студијски програм: Физика, звање/квалификација: Doctor, **признаје се** као диплома докторских академских студија трећег степена високог образовања (180 ЕСПБ), у оквиру образовно-научног поља Природно-математичких наука, научна, односно стручне области Физичке науке, ради запошљавања.

Ово решење омогућава имаоцу општи приступ тржишту рада у Републици Србији, али га не ослобађа од испуњавања посебних услова за бављење професијама које су регулисане законом или другим прописом.

О б р а з л о ж е њ е

Овом министарству обратио се Михаило Чубровић из Београда, Република Србија захтевом за признавање дипломе Универзитета у Лајдену (Universiteit Leiden), Лајден, Краљевина Холандија, о завршеним докторским академским студијама, студијски програм: Физика, звање/квалификација: Doctor, ради запошљавања.

Уз захтев, подносилац захтева доставио је:

1) оверену копију дипломе издате 27.02.2013. године, коју је издао Универзитет у Лајдену (Universiteit Leiden), Лајден, Краљевина Холандија, студије трећег степена високог образовања (180 ЕСПБ), студијски програм : Физика, звање/квалификација: Doctor,
2) оверени превод дипломе са латинског на енглески и са енглеског на српски језик,
3) апстракт рада на енглеском језику,
4) примерак докторске дисертације на изворном језику,
5) радну биографију и листу радова на енглеском језику,
6) пријавни формулар и
7) доказ о уплати таксе за професионално признавање.

Чланом 105 б. став 4. прописано је да Министар доноси решење о професионалном признавању у року од 90 дана од дана пријема уредног захтева.

Одредбама члана 192. Закона о општем управном поступку прописано је да на основу одлучних чињеница утврђених у поступку орган надлежан за решавање доноси решење у управној ствари која је предмет поступка.

Одредбама члана 23. став 2. Закона о државној управи прописано је да Министар представља Министарство, доноси прописе и решења у управним и другим појединачним стварима и одлучује о другим питањима из делокруга Министарства.

Чланом 104. став 1. Закона о високом образовању, прописано је да признавање стране високошколске исправе јесте поступак којим се имаоцу те исправе утврђује право на наставак образовања, односно на запошљавање. Поступак признавања стране високошколске исправе спроводи се у складу са одредбама овог закона, ако међународним уговором није предвиђено другачије.

Сходно одредбама члана 105. став 1. и 6. Закона о високом образовању и васпитању, ENIC/NARIC центар при Министарству просвете, науке и технолошког развоја, прибавио је релевантне информације о студијском програму на ком је стечена диплома из става 2. тачка 1) образложења овог решења.

У складу са чланом 105. став 4. Закона о високом образовању, комисија коју је именовао министар извршила је прво вредновање студијског програма на коме је стечена диплома из става 2. тачка 1) образложења овог решења, и дала предлог за признавање дипломе ради запошљавања.

Подносилац захтева је доставио доказ о уплати таксе у складу са чланом 2. став 1. Правилника о висини таксе за професионално признавање страних високошколских исправа („Службени гласник РС", број 83/2015).

Имајући у виду наведено, решено је као у диспозитиву овог решења.

Упутство о правном средству: Ово решење је коначно у управном поступку и против истог може се покренути управни спор. Тужба се подноси Управном суду у року од 30 дана од дана пријема овог решења.

Решење доставити:
- Михаило Чубровић, ул. Мирослава Јовановића бр. 7/2, 11160 Београд и ※
- Архива.

МИНИСТАР

Младен Шарчевић

Број: 660-01-00006/213
29.11.2017. године
Б е о г р а д

ИНСТИТУТ ЗА ФИЗИКУ
ПРИМЉЕНО: 27 -12- 2017

Рад.јед.	б р о ј	Арх.шифра	Прилог
0801	1897/1		

На основу члана 22. став 2. члана 70. став 4. Закона о научноистраживачкој делатности ("Службени гласник Републике Србије", број 110/05, 50/06 – исправка, 18/10 и 112/15), члана 3. ст. 1. и 3. и члана 40. Правилника о поступку, начину вредновања и квантитативном исказивању научноистраживачких резултата истраживача ("Службени гласник Републике Србије", број 24/16, 21/17 и 38/17) и захтева који је поднео

Институт за физику у Београду

Комисија за стицање научних звања на седници одржаној 29.11.2017. године, донела је

ОДЛУКУ
О СТИЦАЊУ НАУЧНОГ ЗВАЊА

Др Михаило Чубровић

стиче научно звање
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 383/1 од 21.03.2017. године на седници Научног већа Института и поднео захтев Комисији за стицање научних звања број 406/1 од 28.03.2017. године за доношење одлуке о испуњености услова за стицање научног звања **Научни сарадник**.

Комисија за стицање научних звања је по претходно прибављеном позитивном мишљењу Матичног научног одбора за физику на седници одржаној 29.11.2017. године разматрала захтев и утврдила да именовани испуњава услове из члана 70. став 4. Закона о научноистраживачкој делатности ("Службени гласник Републике Србије", број 110/05, 50/06 – исправка,18/10 и 112/15), члана 3. ст. 1. и 3. и члана 40. Правилника о поступку, начину вредновања и квантитативном исказивању научноистраживачких резултата истраживача ("Службени гласник Републике Србије", број 24/16, 21/17 и 38/17) за стицање научног звања **Научни сарадник,** па је одлучила као у изреци ове одлуке.
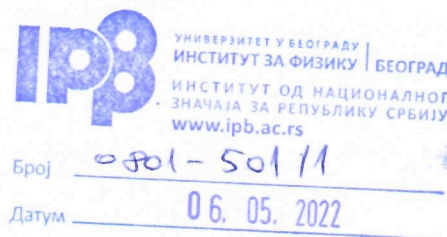
Доношењем ове одлуке именовани стиче сва права која му на основу ње по закону припадају.

Одлуку доставити подносиоцу захтева, именованом и архиви Министарства просвете, науке и технолошког развоја у Београду.

ПРЕДСЕДНИК КОМИСИЈЕ

Др Станислава Стошић-Грујичић,

научни саветник

МИНИСТАР

Младен Шарчевић

ПРИЛОЗИ

Број _0801-501/1_

Датум _06. 05. 2022_

ПОТВРДА О РУКОВОЂЕЊУ ПОТПРОЈЕКТОМ

Овим потврђујем да је научни сарадник **др Михаило Чубровић,** за кога се покреће реизбор у звање научни сарадник, у оквиру Лабораторије за примену рачунара у науци Националног центра изузетних вредности за изучавање комплексних система Института за физику у Београду, руководи потпројектом 3: „Јако корелисани многочестични системи, AdS/CFT кореспонденција и квантна критичност". На поменутом потпројекту су били ангажовани следећи истраживачи: др Михаило Чубровић, др Јакша Вучичевић, др Милош Радоњић.

др Антун Балаж

научни саветник

Руководилац Центра за изучавање комплексних система Института за физику у Београду