

# Defect-induced colossal thermopower in FeSb<sub>2</sub>

Cedomir Petrovic

*Condensed Matter Physics, Brookhaven National Laboratory*

**Abstract.** Recent interest in thermoelectric energy conversion stimulates search for new materials with high thermoelectric performance [1-2]. A narrow distribution or a large peak in the electronic density of states close to the Fermi level is considered favorable for high thermopower [3-4]. Such peak could be induced by the resonant level dopants in semiconductors [5-6] or by the magnetic interaction between the local magnetic moment and itinerant electrons [7-8]. Some strongly correlated materials show significant enhanced thermopower and power factor [9-10]. In this talk I will discuss FeSb<sub>2</sub> [11-13], a correlated electron semiconductor similar to FeSi [14] that was found to host a record-high thermopower of up to 50 mV/K [15]. The mechanism of colossal thermopower in FeSb<sub>2</sub> is presently not understood and moreover there is a wide variety in its reported values. In my talk I show how atomic defects create in-gap states of Fe orbital character that carry high electronic diffusion thermopower whereas phonon drag acting on such states – when crystal is engineered to have high phonon mean free path – enhances thermopower to colossal values. This reveals a subtle interplay of phonon and electronic diffusion mechanisms and points to relevant physics and crystal chemistry that can be exploited in predictive thermoelectric materials design.

## REFERENCES

1. Proc. Natl. Sci. U.S.A. 93, 7436 (1996)
2. Nat. Mater. 7, 105 (2008)
3. Nature 473, 66 (2011)
4. Science 321, 1457 (2008)
5. Science 321, 554 (2008)
6. Energy Environ. Sci. 5, 5510 (2012)
7. Solid State Phys. 51, 81 (1998)
8. Phys. Rev. B 72, 045103 (2005)
9. Proc. Natl. Acad. Sci. U.S.A. 109, 3243 (2012)
10. Phys. Rev. B 83, 125209 (2011)
11. Phys. Rev. B 67, 155205 (2003)
12. Phys. Rev. B 72, 045103 (2005)
13. Phys. Rev. Lett. 109, 256401 (2012)
14. Phys. Rev. Lett. 71, 1748 (1993)
15. Europhys. Lett. 80, 17008 (2007)

2

## 2018 Fall Meeting

### LAYERED, HYBRID AND BIOMATERIALS

H

#### Emerging layered functional materials and their characterization

In layered systems different electronic degrees of freedom compete to result in self-organized textures with varying scales. In such cases the functional properties are described by these defects. Thematic meetings are common, however, EMRS is an ideal platform to discuss different functional properties originating from their layered structural topology.

#### **Scope:**

Various metal oxides/chalcogenides/pnictides with layered structure exhibit interesting and useful functional properties including high temperature superconductivity and giant thermoelectric performance. In these cases, the structural topology is deeply related to strong fluctuations of valence state and local bond. The layered structure topology of the functional materials is important also due to the fact that electronic degrees of freedom in the layered structures have strongly fluctuating character and the phases with charge (or magnetic order), coexisting with metallic (or superconducting) states can provide an effective mechanism for non-conventional phenomena. On the applied side, layered structures permit tuning of properties through external parameters such as doping/intercalation, pressure, strain, electric and magnetic fields. This is of key interest for developing new materials through 'control and manipulation' for desired properties. Here, the focus is to discuss recent advances in the layered functional materials including emerging superconductors in which inhomogeneous ground state plays an important role. In particular, quantitative characterization of these materials is a challenging task requiring space and time resolved experimental tools applied under extreme conditions (e.g. pressure, electric and magnetic fields). The symposium welcomes contributions based on theoretical, experimental and applied aspects of the physics, chemistry, materials science on the hot topics given below.

#### **Hot topics to be covered by the symposium:**

- Physics and chemistry of layered thermoelectric materials
- Defect chemistry of layered pnictides and chalcogenides
- Layered ferroelectrics and quantum paraelectrics
- Pressure induced phases in layered materials
- Intrinsic structure of layered functional materials
- Emerging layered functional materials

#### **List of invited speakers:**

- Neven Barisic, Vienna
- Sara Barja, San Sebastián
- Atsushi Fujimori, Tokyo
- Hidetoshi Fukuyama, Tokyo
- Alexei Gruverman, Lincoln
- Shintaro Ishiwata, Tokyo
- Jun Sung Kim, Pohang
- Kazutaka Kudo, Okayama
- Chul-Ho Lee, Tsukuba
- Morgan Trassin, Zurich
- Jouko Nieminen, Tampere
- Tetsuji Okuda, Kagoshima
- Eugenio Paris, Zurich
- Cedomir Petrovic, Brookhaven
- Wilfrid Prellier, Caen
- Valerio Scagnoli, Zurich
- Shik Shin, Tokyo
- Julia Stähler, Berlin
- Yoshihiko Takano, Tsukuba
- Taishi Takenobu, Nagoya
- Hidenori Takagi, Stuttgart
- Kensei Terashima, Okayama
- Di Yi, Stanford

START AT	SUBJECT	View All	NUM.
14:30	Superconducting Order from Disorder in 2D Charge Density Wave Materials  Authors : Cedomir Petrovic Affiliations : Condensed Matter Physics, Brookhaven National Laboratory  Resume : Superconductivity and charge-density-wave (CDW) are traditionally viewed as Fermi surface instabilities due to electron-phonon coupling whereas arguments have been made both for their cooperation and competition [1-3]. In copper oxides dome of high superconducting T <sub>c</sub> exists at a rather complex phase diagram where disorder and various forms of symmetry breaking orders are present, such as spin-density, CDW or nematic order [4]. In this talk I will discuss emergence of superconductivity from the standpoint of disorder in doped two-dimensional (2D) CDW conductors ZrTe <sub>3</sub> and 2H-TaSe <sub>2-x</sub> S <sub>x</sub> [5-10]. Superconducting domes in these materials exist in the absence of magnetism and could be of interest as an example of non-magnetic limit of copper oxide phase diagram. This work offers new 2D van der Waals bonded bulk single crystals for atomic layer engineering and possible tuning of cooperative phenomena at the nanoscale [11-12]. References: [1] G. Grüner, Rev. Mod. Phys. 60, 1129 (1988), [2] T. Kiss et al., Nature Physics 3, 720 (2007), [3] S. V. Borisenko et al., Phys. Rev. Lett. 102, 166402 (2009), [4] E. Fradkin et al., Rev. Mod. Phys. 87, 457 (2015), [5] Xiangde Zhu et al., Phys. Rev. Lett. 106, 246404 (2011), [6] Hechang Lei et al., Europhys. Lett. 95, 17001 (2011), [7] Xiangde Zhu et al., Sci. Rep. 6, 26974 (2016), [8] Lijun Li et al., NPJ Quantum Materials 2, 11 (2017), [9] M. Hoesch et al., arXiv:1712.03379, [10] A. M. Ganose et al., arXiv:1712.06551, [11] Xiaxiang Xi et al., Phys. Rev. Lett. 117, 106801 (2016), [12] Xiaxiang Xi et al., Nature Physics 12, 139 (2016),		<b>H.3.2</b>
15:00	Superconductivity and polymorphism in hexagonal Pt-based pnictides		<b>H.3.3</b>
15:30	Superconductivity and its Enhancement under High Pressure in "F-free" Single Crystals of CeOBiS <sub>2</sub>		<b>H.3.4</b>
	Layered thermoelectrics and related systems : T. Katsufuji		
16:00	Hole-doping effect on the Néel state of delafossite CuCrO <sub>2</sub>		<b>H.4.1</b>
16:30	Rattling dynamics under a planar coordination without oversized cages		<b>H.4.2</b>
17:00	Thickness-Driven Metal-Insulator Transition in CaVO <sub>3</sub> : A Resonant Inelastic X-ray Scattering Study		<b>H.4.3</b>
	Poster session : T. Mizokawa, C. Kim		
17:30	2D to 3D phase transition study for In <sub>4</sub> Se <sub>3</sub> layered semiconductor crystal intercalated by Ag		<b>H.P.1</b>

[Back to the Symposium Sessions list »](#) <https://www.mrs.org/fall2019/symposium-sessions/symposium-sessions-detail?code=FF01>

**3**

# Symposium FF01 : Beyond Graphene 2D Materials—Synthesis, Properties and Device Applications

2019-12-01

2019-12-02

2019-12-03

2019-12-04

2019-12-05

2019-12-06

2019-12-04 [Show All Abstracts](#)

## Symposium Organizers

Zakaria Al Balushi, University of California, Berkeley

Deep Jariwala, University of Pennsylvania

Olga Kazakova, National Physical Laboratory

Amber McCreary, National Institute of Standards and Technology

## Symposium Support

### Gold

AIXTRON SE

### Silver

2D Crystal Consortium - Materials Innovation Platform (2DCC-MIP)

### Bronze

Accurion Inc.

IOP Publishing Ltd - 2D Materials

Scientia Omicron, Inc.

## FF01.11: Exciton Dynamics in 2D Materials

### Session Chairs

Deep Jariwala

Su Ying Quek

Wednesday AM, December 04, 2019

Hynes, Level 3, Room 312

### 8:00 AM - FF01.11.01

Exciton Dynamics in Atomically Thin Transition Metal Dichalcogenides

[Samuel Brem](#)<sup>1</sup>, [Simon Ovesen](#)<sup>1</sup>, [Ermin Malic](#)<sup>1</sup>

Chalmers University of Technology<sup>1</sup>

[Show Abstract](#)

**9:30 AM - FF01.11.06**

Strongly Anisotropic Diffusion of Excitons in Layered ReS<sub>2</sub> Observed with Transient Absorption Microscopy

Nicolas Gauriot<sup>1</sup>, Hope Bretscher<sup>1</sup>, Jooyoung Sung<sup>1</sup>, Akshay Rao<sup>1</sup>

University of Cambridge<sup>1</sup>

Show Abstract

**9:45 AM - FF01.11.07**

Directional Exciton Transport in a Monolayer WS<sub>2</sub>–WSe<sub>2</sub> Lateral Heterostructure with a Wide Alloy Region

Masafumi Shimasaki<sup>1</sup>, Naoki Wada<sup>2</sup>, Zheng Liu<sup>3</sup>, Kana Kojima<sup>2</sup>, Yasumitsu Miyata<sup>2</sup>, Keisuke Shinokita<sup>1</sup>, Taishi Nishihara<sup>1</sup>, Kazunari Matsuda<sup>1</sup>, Yuhei Miyauchi<sup>1</sup>

Institute of Advanced Energy, Kyoto University<sup>1</sup>, Tokyo Metropolitan University<sup>2</sup>, National Institute of Advanced Industrial Science and Technology<sup>3</sup>

Show Abstract

**10:00 AM - FF01.11**

BREAK

**FF01.12: 2D Magnets—Materials and Properties****Session Chairs**

Angela Hight Walker  
Amber McCreary

Wednesday PM, December 04, 2019  
Hynes, Level 3, Room 312

**10:30 AM - FF01.12.01**

Critical Behavior and Thickness-Dependent Magnetic Order in CrI<sub>3</sub>

Cedomir Petrovic<sup>1</sup>, Yu Liu<sup>1</sup>, Lijun Wu<sup>1</sup>, Xiao Tong<sup>1</sup>, Lijun Wu<sup>1</sup>, Yimei Zhu<sup>1</sup>

Brookhaven National Laboratory<sup>1</sup>

**Hide Abstract**

Two-dimensional (2D) materials with intrinsic ferromagnetism provide unique opportunity to engineer new functionalities in nano-spintronics. One such material is  $\text{CrI}_3$ , a 2D Ising ferromagnet in monolayer with the Curie temperature ( $T_C$ ) of 45 K [1]. Based on critical properties and scaling analysis,  $\text{CrI}_3$  shows three-dimensional (3D) long-range magnetic coupling [2]. In systematic reduction of crystal thickness down to 50 nm bulk  $T_C$  of 61 K is gradually suppressed to 57 K, however, the satellite transition at  $T^* = 45$  K is observed. The  $T^*$  is layer-independent and corresponds to  $T_C$  observed in the monolayer. The critical analysis around  $T_C$  reveals a crossover from 3D to 2D Ising ferromagnetism with mean field type interactions for microscale-thick crystals. This work shows that magnetic transition and critical properties can be continuously tuned on a mesoscale between monolayer and bulk crystals.

**Acknowledgements**

This work has been supported by the Research supported by the U.S. Department of Energy, Office of Basic Energy Sciences as part of the Computation Material Science Program (Y.L. and C. P.) and by the U.S. DOE under Contract No. DE-SC0012704 (L. W. X. T., J. L. and Y.Z.).

**References**

1. B. Huang et al., *Nature* **546**, 270 (2017).
2. Y. Liu et al., *Phys. Rev. B* **97**, 014420 (2018).
3. Y. Liu et al., submitted (2019).

**11:00 AM - FF01.12.02**

The Relation between Magnetism and Optical Properties in Lamellar Transition Metal Phosphor Tri-Chalcogenides

Efrat Lifshitz<sup>1</sup>, Adam Budniak<sup>1</sup>, Esty Ritov<sup>1</sup>, Faris Horani<sup>1</sup>, Yaron Amouyal<sup>1</sup>

Technion - Israel Institute of Technology<sup>1</sup>

Show Abstract

**11:15 AM - FF01.12.03**

Room-Temperature Dilute Magnetic Semiconductor in V-Doped Monolayer  $\text{WSe}_2$

Dinh Loc Duong<sup>1,2</sup>, Seok Joon Yun<sup>1</sup>, Manh Ha Doan<sup>2</sup>, Kirandeep Singh<sup>1</sup>, Thanh Luan Phan<sup>1</sup>, Wooseon Choi<sup>2</sup>, Young Kuk Kim<sup>3</sup>, Young-Min Kim<sup>1,2</sup>, Young Hee Lee<sup>1,2,3</sup>

Center for Integrated Nanostructure Physics (CINAP), Institute for Basic Science (IBS)<sup>1</sup>, Department of Energy Science, Sungkyunkwan University<sup>2</sup>, Department of Physics, Sungkyunkwan University<sup>3</sup>

Show Abstract

**Bulletin of the American Physical Society****APS March Meeting 2012**

Volume 57, Number 1

Monday–Friday, February 27–March 2 2012; Boston, Massachusetts

**Invited Speakers**

<b>Özyilmaz, Barbaros</b> Department of Physics, National University of Singapore	<b>Session D14.00001</b> <a href="#">Spin transport in graphene</a> Room: 212
<b>Aaronson, Scott</b> MIT Dept. of Electrical Engineering and Computer Science	<b>Session V10.00005</b> <a href="#">Entangled states as resources in quantum complexity theory</a> Room: 210A
<b>Abbamonte, Peter</b> University of Illinois	<b>Session A27.00001</b> <a href="#">Dynamic screening and the effective fine structure constant of graphene</a> Room: 258AB
<b>Abild-Pedersen, Frank</b> SUNCAT Center for Interface Science and Catalysis Photon Science, SLAC National Accelerator Laboratory	<b>Session A10.00003</b> <a href="#">Solar energy into fuels - the importance of interface catalysis</a> Room: 210A
<b>Affleck, Ian</b> University of British Columbia	<b>Session L53.00001</b> <a href="#">Lars Onsager Prize Lecture: A Random Walk Through Theoretical Physics</a> Room: 153B
<b>Ahn, Charles</b> Yale University	<b>Session T9.00005</b> <a href="#">Electronic, magnetic, and structural coupling across oxide interfaces</a> Room: 209
<b>Akhmerov, Anton</b> Leiden University	<b>Session D44.00004</b> <a href="#">Manipulation of Majorana fermions using superconducting qubits</a> Room: 157C
<b>Aksimentiev, Aleksei</b> University of Illinois at Urbana-Champaign	<b>Session B44.00001</b> <a href="#">Sequence-dependent ion current modulations in biological and synthetic nanopores</a> Room: 157C
<b>Alber, Mark</b> Department of Applied and Computational Mathematics and Statistics, University of Notre Dame	<b>Session W43.00004</b> <a href="#">Formation and propagation of high density waves during swarming of <i>P. aeruginosa</i></a> Room: 157AB
<b>Alicea, Jason</b> UC Irvine	<b>Session D44.00001</b> <a href="#">Non-abelian anyons and topological quantum information processing in 1D wire networks</a> Room: 157C
<b>Alivisatos, Paul</b> University of California, Berkeley	<b>Session P34.00001</b> <a href="#">Direct imaging of colloidal nanoparticle growth, structure, and assembly in a transmission electron microscope</a> Room: 107A
<b>Alizadeh, Azar</b> GE Global Research	<b>Session B46.00002</b> <a href="#">Development of nanostructured surfaces for ice protection applications</a> Room: 160AB
<b>Allen, Heather</b> The Ohio State University	<b>Session D36.00003</b> <a href="#">Organization at the Air-Aqueous Interface by Heterodyne-detected Phase-Sensitive Sum Frequency Spectroscopy</a> Room: 107C
<b>Altman, Ehud</b> Weizmann Institute of Science	<b>Session P10.00005</b> <a href="#">Mixed Bose-Fermi Mott Phases and Phase Transitions</a> Room: 210A
<b>Altug, Hatice</b> Boston University	<b>Session B42.00001</b> <a href="#">On-chip Metamaterials for Ultra-sensitive Spectroscopy and Identification of Biomolecules</a> Room: 156C
<b>Alvarado-Gil, Juan Jose</b> Applied Physics Department, Cinvestav-Unidad Merida, Carretera antigua a Progreso Km. 6, Merida, Yucatan, Mexico, 97217	<b>Session T46.00002</b> <a href="#">Photoacoustics and Photothermal instrumentation in the study of thermal properties of liquids and semisolids</a> Room: 160AB
<b>Amasha, Sami</b> Stanford University	<b>Session W19.00004</b> <a href="#">Pseudo-spin Resolved Transport Spectroscopy of the Double Dot Kondo Effect</a> Room: 253AB
<b>Ambrosch-Draxl, Claudia</b> University Leoben	<b>Session X10.00002</b> <a href="#">Phonon Raman scattering from first principles</a> Room: 210A
<b>Analytis, James</b> Stanford Institute for Material and Energy Science	<b>Session Q3.00003</b> <a href="#">Nematic susceptibility and quantum criticality in Fe-pnictide superconductors</a> Room: 205AB
<b>Anderson, Philip</b> Princeton Univ	<b>Session L3.00001</b> <a href="#">Hidden Fermi Liquid: Self-Consistent Theory for the Normal State of High-Tc Superconductors</a> Room: 205AB
<b>Anderson, Scott</b> University of Utah	<b>Session Q34.00001</b> <a href="#">Cluster size effects on chemical and physical properties of model catalysts</a> Room: 107A
<b>Ando, Yoichi</b> Institute of Scientific and Industrial Research, Osaka University	<b>Session P27.00003</b> <a href="#">Transport Studies of Topological Insulators and Superconductors</a> Room: 258AB
<b>Ariando, -</b> NUSNNI-Nanocore & Department of Physics, National University of Singapore, Singapore	<b>Session V18.00007</b> <a href="#">Electronic phase separation at the LaAlO<sub>3</sub>/SrTiO<sub>3</sub> interface</a> Room: 252B
<b>Arion, Douglas</b> Carthage College	<b>Session Q37.00001</b> <a href="#">Physicists and Economic Growth: Preparing the Next Generation</a> Room: 108
<b>Armstrong, Andrew</b> Sandia National Laboratories	<b>Session B28.00001</b> <a href="#">Optical signatures of defects in nitride semiconductors</a> Room: 258C
<b>Armstrong, Michael</b> Lawrence Livermore National Laboratory	<b>Session D25.00004</b> <a href="#">Deformation and material dynamics under ultrafast compression</a> Room: 257A
<b>Aronson, Igor</b> Argonne National Laboratory, 9700 South Cass Av, Argonne, IL60439	<b>Session W43.00002</b> <a href="#">The effects of self-induced noise on the onset of collective behavior in suspensions of swimming bacteria</a> Room: 157AB
<b>Arratia, Paulo</b> University of Pennsylvania	<b>Session H20.00001</b> <a href="#">Swimming (&amp;) Propulsion in Viscoelastic Media</a> Room: 253C
<b>Arsenault, Andre</b> Opalux Inc.	<b>Session X20.00003</b> <a href="#">Opalux Photonic Ink: Full-color, bistable, reflective displays</a> Room: 253C
<b>Asai, Yoshihiro</b> Nanosystem Research Institute (NRI) "RICS," National Institute of Advanced Industrial Science and Technology (AIST)	<b>Session Z3.00003</b> <a href="#">Electron correlation effects on the diode properties and the local heating</a> Room: 205AB
<b>Asta, Mark</b> Department of Materials Science and Engineering, University of California, Berkeley	<b>Session J28.00006</b> <a href="#">Thermodynamic Stability of Actinide-Dioxide Solid Solutions and Surface Interactions with Water</a> Room: 258C

This site uses cookies. To find out more, read our Privacy Policy.

 I Agree

**Pasupathy, Abhay**  
Columbia University

**Pecharsky, Vitalij**  
Ames Laboratory US DOE and Department of  
Materials Science and Engineering, Iowa State  
University, Ames, IA 50011-3020

**Pecora, Louis**  
Naval Research Laboratory

**Pederson, Mark**  
Chemical Sciences, Biosciences, and Geosciences  
Division, Office of Basic Energy Sciences, Department  
of Energy

**Pekker, David**  
Caltech

**Pelz, Jon**  
The Ohio State University, Dept. of Physics,  
Columbus, OH 43210

**Pendry, John**  
Imperial College London

**Perdew, John P.**  
Tulane University

**Petrovic, Cedomir**  
Condensed Matter Physics and Materials Science  
Department, Brookhaven National Laboratory

**Petta, Jason**  
Princeton University

**Phillips, Philip**  
Dept. of Physics, University of Illinois, Urbana, IL  
61801

**Phillips, William D.**  
Joint Quantum Institute, University of Maryland and  
National Institute of Standards and Technology, 100  
Bureau Drive, Stop 8424, Gaithersburg MD 20899

**Pine, David**  
New York University

**Poelsema, Bene**  
Physics of Interfaces and Nanomaterials, MESA+  
Institute for Nanotechnology, University of Twente

**Pogorelov, Nikolai**  
Physics Department, University of Alabama in  
Huntsville

**Pokroy, Boaz**  
Department of Materials Engineering and the Russel  
Berrie Nanotechnology Institute, Technion Israel  
Institute of Technology, Haifa, Israel

**Polini, Marco**  
NEST, Istituto Nanoscienze-CNR

**Polzik, Eugene**  
Niels Bohr Institute, Copenhagen University

**Popescu, Gabriel**  
University of Illinois at Urbana-Champaign

**Powers, Thomas R.**  
Brown University

**Prokofiev, Nikolay**  
University of Massachusetts, Amherst

**Prosnitz, Don**  
None

**Proust, Cyril**  
Laboratoire National des Champs Magnétiques  
Intenses (CNRS)

**Prozorov, Ruslan**  
The Ames Laboratory

**Pruschke, Thomas**  
Georg-August-Universität Göttingen

**Punk, Matthias**  
Harvard University

**Qi, Xiao-Liang**  
Stanford University

**Qiu, Z.Q.**  
University of California at Berkeley

**Quinn, Helen**  
Stanford University

**Quinn, Terry**  
Retired

**Raab, Michael**  
Agrivida, Inc.

**Radu, Ilie**  
Radboud University Nijmegen, the Netherlands and  
Helmholtz-Zentrum Berlin, BESSY II, Germany

**Rajan, Krishna**  
Iowa State University

**Ralph, Daniel**  
Cornell University

**Ramana, M.V.**  
Program on Science and Global Security, Princeton  
University

**Ramesh, Ramamoorthy**

[domain-walls manipulated by current](#) Room: 258AB

**Session X12.00001** [Atomic Scale Properties of Chemically Doped Graphene](#) Room:  
210C

**Session Y2.00003** [Optimized Magnetocaloric Materials](#) Room: 204AB

**Session A52.00001** [Regularization of tunneling rates in quantum chaotic systems](#)  
Room: 153C

**Session W34.00002** [DFT-based Modeling of Field-Dependent Control and Response  
of Nanomagnetic Molecules](#) Room: 107A

**Session B10.00003** [The amplitude mode at the superfluid-mott insulator transition](#)  
Room: 210A

**Session T20.00002** [Nanometer-scale properties of metal/oxide interfaces and ``end-  
on'' metal contacts to Si nanowires studied by ballistic electron emission microscopy  
\(BEEEM\)](#) Room: 253C

**Session U60.00003** [Metamaterials, Transformation Optics, and the Science of  
Invisibility](#) Room: *Westin Boston Waterfront Grand Ballroom A/B*

**Session L35.00005** [Toward Improved Semilocal and Nonlocal Density Functionals for  
Atoms, Molecules, and Solids](#) Room: 107B

**Session D22.00001** [Superconductivity in  \$K\_xFe\_{2-y}Se\_{2-z}S\_z\$](#)  Room:  
254B

**Session T29.00001** [Electrical control of single spin dynamics](#) Room: 259A

**Session V19.00002** [Holography and Mottness: A Discrete Marriage](#) Room: 253AB

**Session T19.00002** [Ultracold, trapped atomic gases as material systems](#) Room:  
*Ballroom East*

**Session Y20.00002** [Lock-and-Key Colloids](#) Room: 253C

**Session W27.00003** [Ultrafast mass transport during decay of gigantic Pb mesas on  
Ni\(111\)](#) Room: 258AB

**Session Y10.00005** [Multi-Scale Modeling of the Plasma Flow and Magnetic Fields in  
the Entire Heliosphere](#) Room: 210A

**Session L43.00005** [The role of proteins and peptides in shaping the structure and  
microstructure of biogenic and biomimetic crystals](#) Room: 157AB

**Session A27.00005** [Electron-electron interactions in doped graphene sheets](#) Room:  
258AB

**Session V10.00001** [Entanglement, teleportation and memory in atomic spin  
ensembles](#) Room: 210A

**Session P43.00001** [Tissue Refractive Index Fluctuations Report on Cancer  
Development](#) Room: 157AB

**Session W43.00003** [Synchronization of flagella](#) Room: 157AB

**Session Q4.00004** [Quantum simulations with ultracold atoms](#) Room: 205C

**Session A43.00004** [The Broader Impact Criteria- What's the solution? A panel  
discussion](#) Room: 157AB

**Session D3.00004** [Evidence for competing orders in underdoped  
 \$YBa\_2Cu\_3O\_{7-x}\$](#)  Room: 205AB

**Session Q3.00002** [Doping - dependent anisotropy of the superconducting gap in  
underdoped pnictide superconductors](#) Room: 205AB

**Session T2.00002** [Petascale Many Body Methods for Complex Correlated Systems](#)  
Room: 204AB

**Session H8.00001** [Confinement transitions of Z2 spin liquids on the kagome lattice](#)  
Room: 208

**Session W3.00004** [Generic Wavefunction Description of Fractional Quantum  
Anomalous Hall States and Fractional Topological Insulators](#) Room: 205AB

**Session T15.00001** [Investigation of CoO/Fe/Ag\(001\) and NiO/Fe/Ag\(001\) epitaxial thin  
films X-ray magnetic dichroism](#) Room: 213

**Session J2.00001** [A Framework for K-12 Science Education](#) Room: 204AB

**Session X2.00002** [Beller Lectureship: From Artefacts to Atoms: The Origins and  
Early Years of the International Bureau of Weights and Measures \(BIPM\)](#) Room:  
204AB

**Session X27.00004** [Genetically Engineered Materials for Biofuels Production](#) Room:  
258AB

**Session D15.00001** [Ultrafast Magnetism of Multi-component Ferromagnets and  
Ferrimagnets on the Time Scale of the Exchange Interaction](#) Room: 213

**Session A7.00004** [Mapping the Materials Genome through Combinatorial Informatics](#)  
Room: 207

**Session W19.00002** [Mechanical Control of Spin States in Spin-1 Molecules and the  
Underscreened Kondo Effect](#) Room: 253AB

**Session W20.00005** [Nuclear Power in India](#) Room: 253C

**Session D27.00001** [The DOE SunShot Initiative: Science and Technology to enable](#)

This site uses cookies. To find out more, read our Privacy Policy.

I Agree

## Bulletin of the American Physical Society

### APS March Meeting 2012

Volume 57, Number 1

Monday–Friday, February 27–March 2 2012; Boston, Massachusetts

#### Session D22: Focus Session: Fe-based Superconductors - Crystal Growth, Structure, and Properties of $K_xFe_{2-y}Se_{2-z}$ Phases

2:30 PM–5:30 PM, Monday, February 27, 2012

Room: 254B

Sponsoring Units: DMP DCOMP

Chair: Nicholas Butch, Lawrence Livermore National Laboratory

Abstract ID: BAPS.2012.MAR.D22.1

#### **Abstract: D22.00001 : Superconductivity in $K_xFe_{2-y}Se_{2-z}S_z^*$**

2:30 PM–3:06 PM

[Preview Abstract](#)

[Abstract](#) →

#### **Author:**

Cedomir Petrovic

(Condensed Matter Physics and Materials Science Department, Brookhaven National Laboratory)

Single crystal alloys  $K_xFe_{2-y}Se_{2-z}S_z$  offer valuable insight into the strength of electronic correlations in the normal state and structural characteristics associated with superconductivity. I will discuss the evolution of the superconducting and magnetic ground states as a function of sulfur concentration  $z$  and some noticeable changes in the average and local crystal structure associated with this [1–4]. Conductivity and magnetic properties coincide with stoichiometry changes and with particular local environment of Fe atoms on the two Fe sites in the crystal structure. The ratio of superconducting  $T_c$  and Fermi temperature  $T_F$  is also suppressed by sulfur doping, indicating the suppression of electronic correlations. The superconductivity persists with relatively high  $T_c$  even when electronic correlations in the normal state are greatly reduced. The results for  $z = 0$  will be compared with other experimental techniques that probe nanoscale phase separation and degree of vacancy order [5–6]. It will be shown that local structure and population of particular Fe sites is rather important for obtaining the bulk superconducting phase. Superconducting volume fraction and homogeneity of superconducting phase is in direct competition with Fe vacancy order [7]. [1] Hechang Lei et al., Phys. Rev. Lett. 107, 137002 (2011) [2] Hechang Lei et al., Phys. Rev. B 83, 180503 (2011) [3] Kefeng Wang et al., Phys. Rev. B 84, 054526 (2011) [4] Kefeng Wang et al., Phys. Rev. B 84, 054526 (2011) [5] Z. Wang et al., Phys. Rev. B 83, 140505 (2011) [6] Y. J. Yan et al., arXiv:1104.4941 (2011) [7] Hyejin Ryu et al., arXiv:1111.2597.

\*Work at Brookhaven is supported by the U.S. DOE under Contract No. DE-AC02-98CH10886 and in part by the Center for Emergent Superconductivity, an Energy Frontier Research Center funded by the U.S. DOE, Office for Basic Energy Science (H.Lei).

To cite this abstract, use the following reference: <http://meetings.aps.org/link/BAPS.2012.MAR.D22.1>

This site uses cookies. To find out more, read our [Privacy Policy](#).

I Agree