4th International Conference on

Condensed Matter and Materials Physics

August 16-17, 2018 | London, UK

Scientific Tracks & Abstracts
Day 1

Materials Physics 2018

SESSIONS

Materials Physics | Theoretical and Computational Materials Physics | Magnetic Materials and Optical Materials | Semiconductor Materials

Chair: Subhendra Dev Mahanti, Michigan State University, USA
Co-Chair: Haihan Luo, Shanghai Institute of Technical Physics – CAS, P R China

SESSION INTRODUCTION

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Haihan Luo, Shanghai Institute of Technical Physics – CAS, P R China

Title: Skrymions nucleation in CoFeB amorphous nanodisks: A simulation study
Mohamed EL Hafidi, Hassan II University of Casablanca, Morocco

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Title: CMOS-MEMS accelerometer with gold proof-mass and its application in diagnosis of Parkinson's Disease
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Title: New insight in the physics of RMn_2O_5 multiferroics
Victor Baledent, University of Paris Sud, France

Title: Force field in molecular simulations, limitations, applications and perspectives in diffrent areas of science
Edgar Nuñez Rojas, National Council of Science and Technology – UAM, Mexico

Title: Polymer composite materials and their application in designs of gas turbine engine
Sergei V Aliukov, South Ural State University, Russia

Title: Supercurrent and transport properties of mesoscopic SNFS Josephson junction under the injection of spin polarized current
Golikova T E, Institute of Solid State Physics - RAS, Russia

Title: Can superconductivity persist in arbitrarily small particles?
Pushan Ayyub, TIFR, India

Title: Room temperature ferromagnetism in various non-magnetic oxides
Homnath Luitel, VECC, India

Title: Interconnection of charge neutrality level with electronic structure and p-d hybridization and its modification upon electronic excitation
Arkaprava Das, Inter University Accelerator Centre, India

Haihan Luo et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Study on the infrared optical properties and the microstructure of cesium iodide thin film

Haihan Luo and **Dingquan Liu**
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The infrared optical properties and the microstructure of cesium iodide (CSI) thin film have been investigated. In this paper, the cesium iodide thin film were prepared on CVD (chemical vapour deposition) diamond substrate by molybdenum boat thermal evaporation in 2×10^{-3} Pa vacuum pressure, while deposition rate was monitored and demonstrated at 2~3 nm/s by quartz crystal oscillation controller. The films were observed and analyzed by the Fourier transform infrared spectrometer, X-ray diffraction analyzer and scanning electron microscopy. CSI film infrared spectra transmittance curve shows that the cesium iodide transparent area can be up to 80 micron which is the far infrared region. When affected by the moist air, the spectral curve shows the appearance of the infrared absorption band in the ranges of 2.66~2.85 μm. XRD results indicate the cesium iodide film is polycrystalline. And the scanning electron microscopy results shows that the average grain size of the cesium iodide film become larger after the cesium iodide film is placed in the moist air.

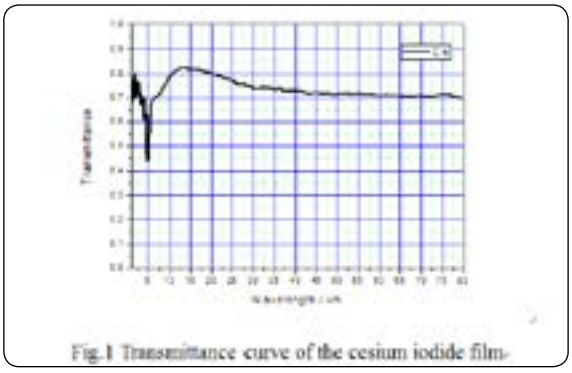

Fig.1 Transmittance curve of the cesium iodide film.

Recent Publications

1. Gu Mu et al. (2010) Crystal growth and characterization of CuI single crystals by solvent evaporation technique. Mater. Res. Bull. 45(5):636-639.
2. Wei Zong Ying and Zhu Ren Yuan (1993) Study on undoped CsI crystals. Nucl. Instrum. Methods. Phys. Res. A. 326:508-512.
3. H H Luo et al. (2014) Optical character study of silicon optical films in different deposited temperature. Acta Optica Sinica. 34(4):0431001.

Biography

Haihan Luo obtained his BS Degree in Physics Department from Nanjing University in 2006 and his PhD Degree in Physical Electronics from University of Chinese Academy of Sciences in 2012 (China) respectively. He is currently working in the Department of Optical Coatings and Materials at the Shanghai Institute of Technical Physics of the Chinese Academy of Sciences. His research interests are focused on micro-nano integrated optical devices, far infrared optical interference filters design and manufacturing and optical properties analysis of thin film materials..

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Mohamed El Hafidi, Res. Rev. J Mat. Sci. 2018, Volume 6
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Skrymions nucleation in CoFeB amorphous nanodisks: A simulation study

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The emergence of topological structures, such as magnetic skyrmions and vortices gave a great push in memories construction. In this work, we investigate skyrmions nucleation and annihilation, and their stabilization in an amorphous ferromagnetic Co0.400Fe0.40B0.20/Pt(1.3nm) nanodisk (Fig.1.). This kind of nanomaterials are characterized by their strong perpendicular magnetic anisotropy PMA and high interface Dzyaloshinskii-Moriya interaction iDMI values (0 < D <0.45 mJ/m2) depending on the platinum layer thickness providing ideal conditions for skyrmions birth. Notice that skyrmions are promising for ultracompact data storage processing and may open up emerging field of potential applications. This study is accomplished within the framework of a phenomenological continuum model established to characterize the chiral states in the system. Simulations are carried out using Mumax3 software. We show that iDMI We show that iDMI favors the appearance of skyrmions in a limited range. We also elucidate the effect of a magnetic field applied perpendicularly to the plane of the nanodisk as well as the diameter of the nanodisk on the skyrmions stabilization.

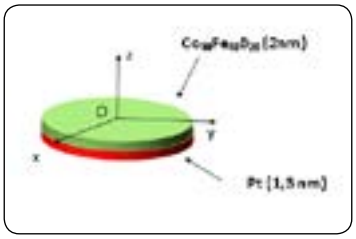

Fig.1: Schematic representation of the investigated nanodisk.

Recent Publications

1. M. Fattouhi, M.Y. El hafidi and M. EL HAFIDI (2018) Single Skyrmion induced by external magnetic field in CoFeB ferromagnetic alloy nanodisks. J.M.M.M accepted, https://doi.org/10.1016/j.jmmm.2018.07.054
2. M. Fattouhi • M. Y. El Hafidi • M. El Hafidi • A. Kassiba and • N. Yaacoub. (2018) Study of Nucleation/Annihilation Process and Vortices Characteristics in Co/Py Rectangular Bilayers. Journal of Superconductivity and Novel Magnetism. https://doi.org/10.1007/s10948-018-4725-5.

Biography

Mohamed El Hafidi is Professor of Quantum Physics and Magnetism at Hassan University II of Casablanca (Morocco) since 1985. He prepared a part of his PhD at the High Magnetic Field Laboratory (Grenoble, France) and he stayed as a visiting professor at Joseph Fourier University of Grenoble. He currently supervises research on topological structures and low dimensionality magnetic systems.

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Loik Gence et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Micro texturing tin and Ag coating for flexible and transparent electronics

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[2]University of Chile, Chile
[3]The Institute of Scientific and Industrial Research - Osaka University, Japan

Since a few years, the semiconductor industry is looking for answering to the growing demand for new electronic devices with the ability to be (inter-) connected for sharing informations with people and other devices within the framework of the so-called Internet of Everything (IoE). This demand will explode in the next few years, and will require the development of new materials and technologies that are lighter, flexible, low-power and that can be integrated in wearable devices, sensors, displays and actuators. Polymer substrates, were recently proposed as a potential candidates for light-weight, flexible and greener electronic devices. Here we studied the fabrication of conductive nanocellulose (nanopaper) substrates for flexible solar cell and electronic devices applications. Sputtered titanium nitride (TiN) were deposited onto nanopaper substrates using radio frequency capacitively coupled plasma (RFCCP). Their electrical and optical properties were scrutinized as a function of substrate synthesis and TiN deposition parameters. Micro-texturing of the TiN coating is proposed for optimizing their electro-optical properties. The electrical and optical TiN properties were compared with commercially available PET/ITO substrates and Ag Nanowires (NWs) coatings already proposed as electrodes for nanopaper-based electronics. Moreover, the conductivities of ITO, Ag NWs and TiN electrodes were scrutinized under repetitive mechanical stress, using a bending machine.

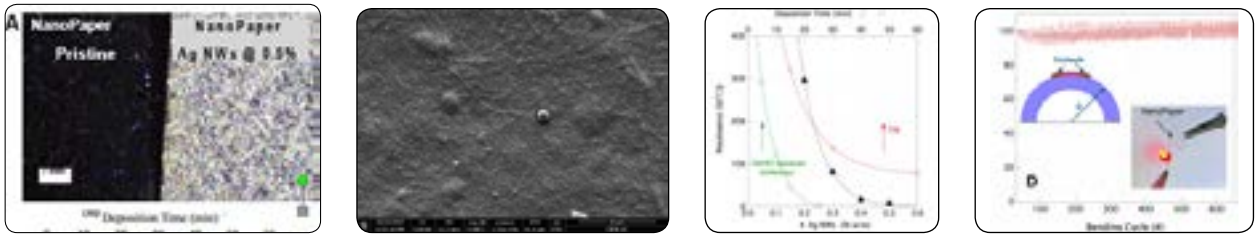

Figure 1: Optical view of (A) Nanopaper substrate before and after the deposition of Ag Nws. B) Sem image of a tin coating sputtered onto nanopaper. (C) Square resistance of nanopaper and PET substrates as function of Ag NWs density and TiN deposition time. (D) Square resistance of a TiN coated nanopaper after 650 mechanical bending. The inset show the bending principle.

Recent Publications

1. International Technology Roadmap for Semiconductors Edition 2.0 (2015)
2. H Zhu et al. (2016) Wood derived materials for green electronics, biological devices, and energy applications Chem. Rev. 116:9305-9374.
3. M Nogi et al. (2015) Transparent conductive nanofiber paper for foldable solar cells. Scientific Reports. 5:17254.
4. U Celano et al. (2016) All-nanocellulose nonvolatile resistive memory. NPG Asia Materials. 8:e310.
5. C L Kim et al. (2017) A highly flexible transparent conductive electrode based on nanomaterials. NPG Asia Materials. 9:e438.

Biography

Loïk Gence is received his PhD from Catholic University of Louvain, Belgiuma and he is presently Assistant Professor in Instituto de Física of Pontificia Universidad Catolica de Chile, Chile.

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Kazuya Masu et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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CMOS-MEMS accelerometer with gold proof-mass and its application in diagnosis of Parkinson's Disease

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Tokyo Institute of Technology, Japan

This paper presents our recent progress of a high sensitivity complementary metal-oxide semiconductor-microelectromechanical systems (CMOS-MEMS) accelerometer with gold proof-mass and its application in diagnosis of Parkinson's disease. The feature of the CMOS-MEMS accelerometer is the use of gold proof-mass. High density of gold enables us to increase the sensitivity by reducing thermo-mechanical noise that is inversely proportional to the proof mass. We then show the developed CMOS-MEMS multi-physics design environment. An equivalent circuit of a MEMS accelerometer has been designed to simultaneously understand both the mechanical and the electrical behaviors. One of the potential applications of the high sensitivity accelerometer is also discussed by focusing on early-stage diagnosis of Parkinson's disease.

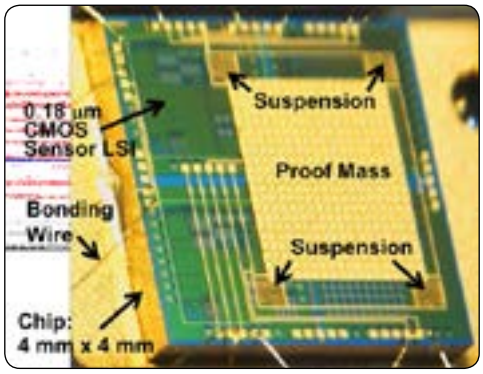

Figure 1: Chip photo of CMOS-MEMS accelerometer with gold proof-mass.

Recent Publications

1. K Machida et al. (2014) Integrated CMOS-MEMS technology and its applications. ECS Trans. 61(6):21-39.
2. D Yamane et al. (2014) Design of sub-1g microelectromechanical systems accelerometers. Appl. Phys. Lett. 104(7):074102.
3. T Konishi et al. (2014) A capacitive CMOS-MEMS sensor designed by multi-physics simulation for integrated CMOS-MEMS technology. Jpn. J. Appl. Phys. 53(4S):04EE15.
4. C Y Chen et al. (2016) Pulse electroplating of ultra-fine grained Au films with high compressive strength. Electrochemistry Communication. 67(C):51-54.

Biography

Kazuya Masu obtained his BE, ME and PhD Degrees in Electronics Engineering from Tokyo Institute of Technology (Tokyo Tech), Japan. He was an Assistant Professor and an Associate Professor with Tohoku University from 1982. In 2000, he moved to Tokyo Tech. He is currently a Professor and Director General of Institute of Innovative Research at the same university. He was a Visiting Professor in Georgia Institute of Technology in 2002 and 2005 respectively. He received IEICE Electronics Society Award in 2004, IEICE Achievement Award in 2013 and IEEJ Outstanding Achievement Award in 2014. He served as Vice President of JSAP in 2014-2015. He is JSAP Fellow, IEEJ Fellow, and IEICE Fellow.

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Victor Balédent, Res. Rev. J Mat. Sci. 2018, Volume 6
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New insight in the physics of RMn_2O_5 multiferroics

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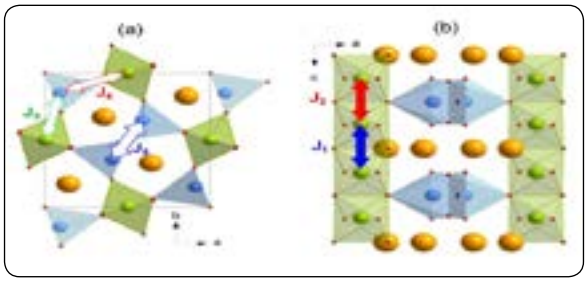
RMn_2O_5 materials have long been presented as spin induced multiferroic family, where the electric polarization develops concomitantly with a magnetic transition at low temperature. The complex magnetic order originates from the frustration of anti-ferromagnetic loops of 5 sites in the (a,b) plane as illustrated in the Figure. What makes them particularly interesting lies in their singular properties: an electric polarization among the strongest reported so far ($3600\mu C.cm^{-2}$ in $GdMn_2O_5$), a strong magneto-electric coupling (enabling a polarization flip under a magnetic field of 2T in $TbMn_2O_5$), and a magnetism that indicates a different fundamental mechanism than the standard Dzyaloshinskii-Moriya Interaction. In this presentation, I will present our recent results on both atomic and magnetic structures of several members of this family, shedding a new light on the physic and problematic of RMn_2O_5.



Recent Publications

1. S Chattopadhyay et al. (2017) 3d- 4f coupling and multiferroicity in frustrated Cairo pentagonal oxide $DyMn_2O_5$. Scientific Report.
2. W Peng et al. (2017) Toward pressure- induced multiferroicity in $PrMn_2O_5$. Physical Review B. 96:054418.
3. G Yahia et al. (2017) Recognition of exchange striction as the origin of magnetoelectric coupling in multiferroics. Physical Review B. 95:184112.
4. S Chattopadhyay et al. (2016) Evidence of multiferroicity in $NdMn_2O_5$. Physical Review B. 93:104406.
5. V Balédent S et al. (2015) Evidence for room temperature electric polarization in RMn_2O_5 Physical Review Letters. 114:117601.

Biography

Victor Balédent obtained his PhD (Physics) in 2010 for his work on the magnetic properties of superconducting cuprates studied by neutron scattering, awarded by a prize from the French Neutron Society. During a two years Postdoc at synchrotron SOLEIL, he extend his research to various superconducting materials (pnictides, heavy fermions, cuprates) and widens his scientific thematics to metal-insulating transitions and multiferroicity. He is currently an Associate Professor at the University of Paris Sud, Orsay, France. He was recruited as an Assistant Professor in 2013 at the Laboratory of Solid Physics, Orsay, France. His research focus on the manifestation of electronic correlations in physical properties in several classes of material from Mott-insulators and superconductivity through multiferroics. Techniques used are neutron and X-ray elastic and inelastic scattering with different sample environment : high pressure, magnetic field and low temperature.

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Edgar Núñez Rojas, Res. Rev. J Mat. Sci. 2018, Volume 6
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Force field in molecular simulations, limitations, applications and perspectives in different areas of science

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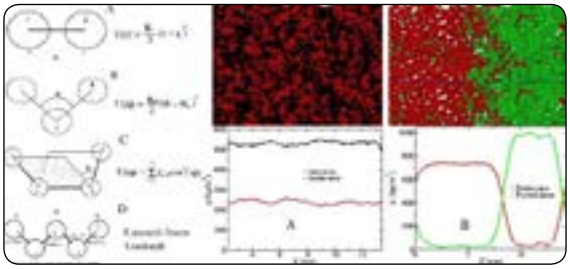
Physical properties of a molecular system are function of the interaction among molecules and atoms which form such system. These interactions are divided in two kinds, intramolecular and intermolecular. Intramolecular interactions describe the energetic contribution due to the interactions within the molecular structure, namely, bonds, angle bonds and torsions mainly; functions used for these interactions are harmonic potentials- a special mathematical models for the dihedral angle. Intermolecular potentials describe the energetic contribution of the interaction between atoms which belong to different molecules in a system, they are modeled with Lennard-Jones and Coulombic potential. In molecular simulations, the force field is essential. It is a mathematical function which includes all the energetic contributions mentioned above. Also, the force field is the set of parameters required for all the terms of the mentioned function (force constants for the harmonic, constants for the functions of the torsions, equilibrium distances and angles, Lennard-Jones parameters and electrical charges, etc.). Understanding the force field and its development has allowed the description, with some limitations, of the physical behavior of molecular systems and therefore, giving a predictive character to this methodology.



Recent Publications

1. F J Salas et al. (2015) Systematic procedure to parametrize force fields for molecular fluids. Journal of Chemical Theory and Computation 11(2):683-693.
2. AP de la Luz et al. (2015) A new force field of formamide and the effect of the dielectric constant on miscibility. Journal of Chemical Theory and Computation.11(6):2792-2800.
3. E Núñez Rojas et al. (2017) Molecular dynamics simulations to separate benzene from hydrocarbons using polar and ionic liquid solvents. Journal of Molecular Liquids. 249:591-599.
4. F J Salas, E Núñez Rojas and J Alejandre (2017) Stability of formic acid/pyridine and isonicotinamide/formamide cocrystals by molecular dynamics simulations. Theoretical Chemistry Accounts. 136(1):17.
5. E Núñez Rojas et al. (2018) Force field benchmark of the TraPPE UA for polar liquids: density, heat of vaporization, dielectric constant, surface tension, volumetric expansion coefficient and isothermal compressibility. The Journal of Physical Chemistry B. 122(5):16669-1678.

Biography

Edgar Núñez Rojas has received Degree in Chemical Engineering, UNAM School of Chemistry, Master of Science in Materials Engineering, UNAM Materials Research Institute, Doctorate in Materials Science and Engineering, Materials Research Institute UNAM, two years of postdoctoral stay at the UAM-Iztapalapa , eleven years as a subject teacher at the Faculty of Chemistry, UNAM. Two quarters as a tenured professor level C at the UAM-Iztapalapa. He currently works at the UAM-Iztapalapa as the CONACyT Chair in the Chemistry Department.

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Sergei V Aliukov et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Polymer composite materials and their application in designs of gas turbine engine

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At present, there is a tendency to replace metals with nonmetals, including composite materials. More and more works are devoted to the creation and investigation of the structure and properties of high-temperature nonmetallic materials. Composites, being a heterogeneous anisotropic or quasi-isotropic system, combining the positive properties of components and possessing a complex of new properties not inherent in any of them, allow to substantially improve the basic characteristics of materials. The main requirement applied to the inlet housing of gas turbine engines made of polymer composite materials is the ability to withstand a high operating temperature. Modern polymer composite materials consist of reinforcing fillers and a polymer matrix. Reinforcing fillers can be made of: fiberglass, organic fiber, carbon fiber and are able to withstand the required operating temperature with ease. Thus, the task of selecting polymer composite materials for an input device is reduced to the selection of a polymer matrix connecting the reinforcing filler. This article analyzes the use of polymer composite materials in the details of gas turbine engines of aircrafts, the most promising components of polymer composite materials for manufacturing the input case of a helicopter gas turbine engine have been selected. Samples were made and mechanical tests of polymer composite materials were carried out. Based on the results of the research, the choice of the most promising polymeric composite material was made. The experimental studies carried out on the two most promising materials showed the advantages of a material that has a significantly larger temperature range of operation and has a large margin for modification. It is shown that heat-resistant materials with short-fiber filler can be a worthy replacement for aluminum alloy in the design of the input device.

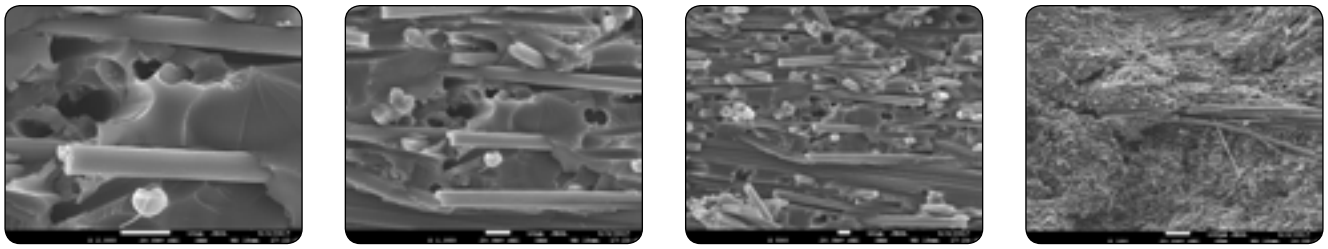

Figure 1: SEM images with different magnifications.

Recent Publications

1. Aliukov S (2018) Approximation of electrocardiograms with help of new mathematical methods. Computational Mathematics and Modeling 29(1):59-70.
2. Dubrovskiy A et al. (2017) Basic characteristics of adaptive suspensions of vehicles with new principle of operation, SAE International Journal of Commercial Vehicles. 10(1):193-203.

Biography

Sergei V Aliukov has been doing his scientific research in different areas of his activity, namely, in Engineering, Materials Science, Mathematics, and others. He has published 3 monographs and more than 100 papers. He has developed new methods of approximation of generalized and piece-wise functions and some physical and mathematical models of dynamical processes.

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Golikova T E et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Supercurrent and transport properties of mesoscopic SNFS Josephson junction under the injection of spin polarized current

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Institute of Solid State Physics - RAS, Russia

Mesoscopic hybrid planar Josephson junctions have attracted a lot of interest in the recent decade in terms of their possible applications in the electronics, spintronics, quantum computing and fundamental research. We have investigated the transport properties of Josephson junctions based on superconductor – normal metal/ ferromagnet – superconductor (Al-Cu/Fe-Al) with double layered N/F weak link (Cu/Fe) under the controllable spin polarized current injection at low temperatures and in weak magnetic fields. Spin polarized current was injected in the middle of the Josephson junction from the perpendicular ferromagnet electrode. We have observed the supercurrent in this type of junctions show nonlinear dependence of low values injection current from F-electrode. We claimed that this effect is due to 0-π transition, i.e. the fundamental Josephson relation can be changed from $I=I_c\sin\Phi$ to $I=I_c\sin(\Phi+\pi)$ by controlling not only energy distribution as it was done in but also with the presence of spin polarization of the injection current. Our experiments also demonstrated the appearance of double-peak peculiarity in differential resistance at high values of the injection current which is assumed to be due to the double proximity effect.

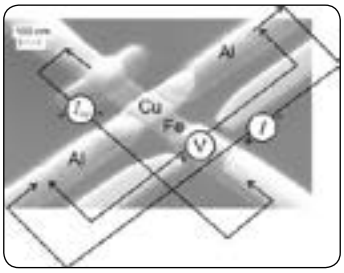

Figure 1: SEM image of the multiterminal Al-(Cu/Fe)-Al Josephson junction together with the measurement scheme.

Recent Publications

1. F J Jedema et al. (2002) Electrical detection of spin procession in a metallic mesoscopic spin valve. Nature. 416:713-716.
2. T Yu Karminskaya et al. (2010) Josephson effect in superconductor/ferromagnet structures with a complex weal link region. Phys. Rev. B. 81:214518.
3. T E Golikova et al. (2012) Double proximity effect in hybrid planar superconductor (normal/metal/ferromagnet)-superconductor structures. Phys. Rev. B 86:064416.

Biography

Golikova T E obtained her PhD Degree in Physics in 2014 and she is working on experimental investigation of the interplay of superconductivity and magnetism at low temperatures involving structure fabrication with the nanotechnology tools. Her research interest include: superconductivity and magnetism, spintronics, Josephson junctions.

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Pushan Ayyub, Res. Rev. J Mat. Sci. 2018, Volume 6
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Can superconductivity persist in arbitrarily small particles?

Pushan Ayyub
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The study of superconductivity in nanostructured systems is particularly fascinating due to the existence of a multitude of length scales, such as the coherence length (ξ) and the penetration depth (λ_L). Here, we focus on quasi-zero dimensional superconductors, such as isolated nanoparticles or nanocrystalline solids. In such systems, superconductivity usually persists down to length scales much smaller than ξ and λ_L. Ultimately, the lower size limit for superconducting order to exist is set by the 'Anderson criterion', which arises from quantum confinement and is believed to be remarkably accurate and universal. We report, however, a recent result that questions the validity of the Anderson criterion. We show that phase-pure, nanocrystalline bcc-Ta remains superconducting (with, $T_C \approx 0.9K$) down to sizes 40% below the conventional estimate of the Anderson limit for Ta (4.0nm). Further, both the T_C and H_C exhibit unusual, non-monotonic size dependences, which we explain in terms of a complex interplay of quantum size effects, surface phonon softening and lattice expansion. An estimation of T_C within first-principles density functional theory shows that even a moderate lattice expansion allows superconductivity in Ta to persist down to sizes much below the Anderson limit. This indicates the possibility of bypassing the Anderson criterion by suitable crystal engineering and obtaining superconductivity at arbitrarily small sizes, an obviously exciting prospect for futuristic quantum technologies. We take a critical look at how lattice expansion modifies the Anderson limit, an issue of fundamental interest to nanoscale superconductivity.

Recent Publications

1. S K Mohanta et al. (2016) Size-induced crossover from itinerant to localized magnetism observed for isolated Fe impurities embedded in different structural polymorphs of silver. Physical Review B. 94:184431.
2. M Dalui et al. (2015) Preferential enhancement of laser-driven carbon ion acceleration from optimized nanostructured surfaces. *Scientific Reports* 5:11930.
3. S Chattopadhyay et al. (2015) Local structure, composition and crystallization mechanism of a model two-phase composite nanoglass. J. Chemical Physics. 144(6):064503.
4. S Bose and P Ayyub (2014) A review of finite size effects in quasi-zero dimensional superconductors. Reports Progress Physics. 77(11):116503.

Biography

Pushan Ayyub is a Senior Professor and Chair in the Department of Condensed Matter Physics at the Tata Institute of Fundamental Research, Mumbai, India. He has over 160 publications in the general area of nanoscience. He was a Member of the International Committee on Nanostructured Materials (1998-2008) and is currently a Member of the Nano Mission Council of the Government of India. He is a Fellow of the Indian National Science Academy. His research interests include the size dependence of superconductivity and ferroelectricity. He is particularly interested in size-induced structural phase transitions and stabilization of novel crystal structures.

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Notes:

Homnath Luitel et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Room temperature ferromagnetism in various non-magnetic oxides

Homnath Luitel and **D Sanyal**
VECC, India

Ab-initio calculations on the possibility of room temperature ferromagnetic ordering in non-magnetic oxides have been performed by doping various p-block elements X (X=B, C, N, Al, Si, P, S, Ga, Ge and As) in ZnO, TiO_2, MgO, SnO_2 etc. The spin-polarized density of states calculation has been performed using the code MedeA VASP for all the structures with two same p-block elements, doped at oxygen sites. A significant amount of induced magnetic moment has been observed in some cases. The sources of magnetism are np orbital electrons of the dopants along with the 2p orbital electrons of neighboring oxygen atoms. Among them, stable ferromagnetic (spin triplet) ordering states have been identified and the theoretical calculations have been verified by experiments. The room temperature ferromagnetic properties of various semiconducting oxides can be useful for spintronics applications in future. A detailed result of spin-spin interaction study along with our experimental observations for room temperature ferromagnetism in different systems will be presented.

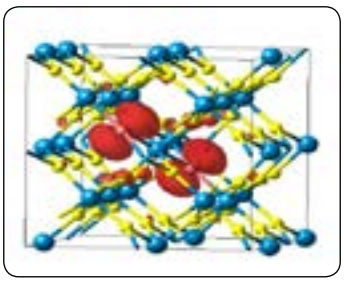

Figure 1: Local magnetic density distribution for P doped SnO_2. The source of magnetism is the P-atom doped at O-site in SnO_2.

Recent Publications

1. Luitel H et al. (2016) Positron annihilation lifetime characterization of oxygen ion irradiated rutile TiO_2. Nuclear Instruments and Methods B. 379:215-218.
2. Luitel H and Sanyal D (2017) *Ab initio* calculation of magnetic properties in B, Al, C, Si, N, P and As doped rutile TiO_2. Int. J. Mod. Phys. B. 31:1750227.
3. Luitel H et al. () Defect generation and recovery in polycrystalline ZnO during annealing below 300˚C as studied by *in situ* positron annihilation spectroscopy. J. Mat. Sc. 52:7615.
4. Luitel H Roy S and Sanyal D (2018) Ferromagnetism in P and As doped SnO_2: first-principle study. Computational Condensed Matter. 14:36-39.
5. Sarkar A et al. (2017) Positron annihilation spectroscopic characterization of defects in wide band gap oxide. Semiconductors. Mat. Res. Exp. 4(3):035909.

Biography

Homnath Luitel is a PhD student at Variable Energy Cyclotron Centre (VECC), a research institute in Kolkata. He has done his Post MSc course from the same institute and has registered for PhD program under Homi Bhabha National Institute (HBNI), Mumbai. His research area mainly focuses on room temperature ferromagnetism in various non-magnetic semiconducting oxides; and also dilute magnetic semiconductors, defects characterization, etc.

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Arkaprava Das et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Interconnection of charge neutrality level with electronic structure and p-d hybridization and its modification upon electronic excitation

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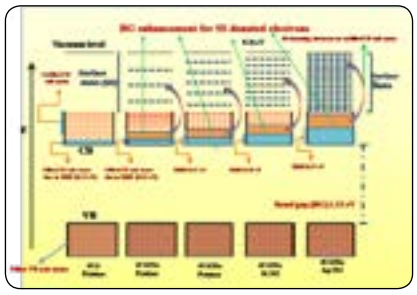
[1]Inter University Accelerator Centre, India
[2]UGC-DAE Consortium for Scientific Research, India

Undoped and tin doped cadmium oxide (CdO) based thin films are irradiated by 84 MeV Si^{6+} and 120 MeV Ag^{9+} ions. In the present work the charge nutrality level (CNL) in highly conducting CdO thin films is demonstarted by the observed variation in the band gap upon annealing and doping. The increase in crystallite size with tin doping is a signature of decrease of CdO stoichiometry by substitutional replacement of Cd with Sn. Each Cd^{2+} ions are substituted by Sn^{2+} ions with reduction of Sn^{4+} via creating oxygen vacancies in the lattice which also enhnaces the carrier concentration in the tin doped thin film. The band gap enhancement cannot be explained by Burstein Moss Shift (BMS) only but can be explained by formation of charge neutrality level (CNL). The level of local CNL resides at the branch point of virtual gap states (ViGS) generation of which is the consequence of tin doping in CdO lattice. Further investigations using soft X-ray absorption spectroscopy (SXAS) at oxygen K and cadmium M edge and the analysis of the spectral features has revealed an evidence of p-d interaction between O 2p and Cd 4d orbitals. After irradiation, the thin films exhibit an unusual band gap enhancement via generation of oxygen vacancies due to huge electronic energy deposition inside the lattice by Ag and Si ions. The observed band gap enhancement has been substantiated by a schematic block diagram.



Recent Publications

1. Arkaprava Das et al. (2017) Virtual gap states induced modifications in charge neutrality level in cadmium oxide thin films. Materials Research Express. 4(4):045901.
2. Arkaprava Das et al. (2016) Electronic structure modification and Fermi level shifting in niobium doped anatase titanium dioxide thin films: a comparative study of NEXAFS, work function and stiffening of phonons. Physical Chemistry Chemical Physics. 18(5):36183627.
3. Arkaprava Das et al. (2016) Micro-Raman and electronic structure study on kinetics of electronic excitations induced monoclinic to tetragonal phase transition in zirconium oxide films. RSC Advances. 6(106):104425-104432.
4. Subodh K Gautam et al. (2016) Carrier transport mechanism of highly-sensitive niobium doped titanium dioxide/p-Si heterojunction photodiode under illuminations by solar simulated light. Journal of Applied Physics. 120:214502.
5. Rakesh C Ramola et al. Study of phase transformation induced by electronic excitation in pure and yttrium doped ZrO_2 thin films. Material Research Express. 4(9):096401.

Biography

Arkaprava Das is a senior research scholar in Inter University Accelerator centre, New Delhi, India and has his research work focused on the development of undoped and doped cadmium oxide (CdO) thin films and their nanocomposites (NCs) for studying various phase transformation phenomenon besides the scope of their potential applications.

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SESSION INTRODUCTION

Title: Geometrically frustrated magnetism and quantum atomic properties in hydroxyl salts
X G Zheng, Saga University, Japan

Title: Primary scaling densities in the critical adsorption of Ising systems
Zoran Borjan, University of Belgrade, Serbia

Title: Properties of a weakly ionized NO gas sensor based on multi-walled carbon nanotubes
Yong Zhang, Xi'an Jiaotong University, P R China

Title: The microscopic origin of size-dependent lattice contraction and expansion
Pushan Ayyub, TIFR, India

Title: Magnetic properties of six-legs spin-S (S=½, 1) Ising nanotube under the effect of an external field
Mohamed EL Hafidi, Hassan II University of Casablanca, Morocco

Title: Nonlocal supercurrent in mesocopic multiterminal SNS Josephson junction
Golikova T E, Institute of Solid State Physics - RAS, Russia

Title: Synthesis of a stable HCP-FCC mixture phase of the high-entropy superalloys $Al_{0.15}Co_{0.18}Cr_{0.12}Fe_{0.11}Ni_{0.36}Ti_{0.08}$ at high pressure
Chih Ming Lin, National Tsing Hua University, Taiwan

X G Zheng, Res. Rev. J Mat. Sci. 2018, Volume 6
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Geometrically frustrated magnetism and quantum atomic properties in hydroxyl salts

X G Zheng
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Hydroxyl salts exist in nature. The most familiar might be the hydroxyl chloride $Cu_2(OH)_3Cl$ (atacamite), which forms naturally on copper and bronze as a green patina and is widely recognized as imparting characteristics to the Statue of Liberty. But only in recent years, their intriguing magnetism, with prominent geometric frustration, have been uncovered by us. Geometrically frustrated magnets, in which localized magnetic moments on triangular, kagome or pyrochlore lattices interact through competing exchange interactions, have been of intense recent interest due to the diversity in the exotic ground states that they display and potential applications that they may bring out. The diverse experimental reports of unconventional magnetic properties also provide challenge and testing ground for theoretical models. Till now, we have discovered that the hydroxyl salts of the type $M_2(OH)_3Cl$ or M(OH)Cl, where M is a magnetic ion of Cu^{2+}, Ni^{2+}, Co^{2+}, Fe^{2+}, or Mn^{2+}, are geometrically frustrated magnets resulting from their crystal structures as illustrated in figure I. Furthermore, in some of these compounds we found the occurrence of ferroelectricity with multiferroic features. In this talk, I will review our experimental results on hydroxyl salts, together with a brief introduction to a less-known experimental technique μSR.

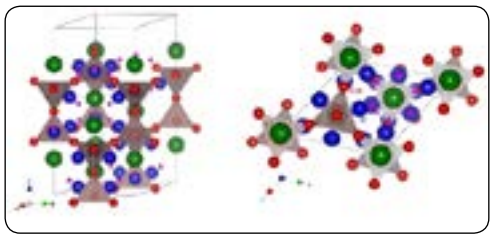

Figure 1: Typical structure in hydroxyl salts $Co_2(OH)_3Cl$.

Recent Publications:

1. X G Zheng et al. (2005) Coexistence of long-range order and spin fluctuation in geometrically frustrated clinoatacamite $Cu_2Cl(OH)_3$. Physical Review Letters. 95(5):057201.
2. X G Zheng et al. (2006) Coexisting ferromagnetic order and disorder in a uniform system of hydroxyhalide $Co_2(OH)_3Cl$. Physical Review Letters. 97(24):247204.
3. X G Zheng et al. (2008) Giant negative thermal expansion in magnetic nanocrystals. Nature Nanotechnology. 3:724-726.
4. Masayoshi Fujihala et al. (2014) Unconventional spin freezing in the highly two-dimensional spin-1/2 kagome antiferromagnet, $Cd_2Cu_3(OH)_6(SO_4)_24H_2O$: evidence of partial order and coexisting spin singlet state on a distorted kagome lattice. Physical Review B. 89:100401.
5. Xing Liang Xu et al. (2017) Critical slowing of quantum atomic deuterium/hydrogen with features of multiferroicity in the geometrically frustrated system $Co_2(OD)3Cl/Co_2(OH)_3Cl$. Physical Review B. 95:024111.

Biography

X G Zheng is received his PhD in Electrical Engineering from School of Engineering, Kyushu University during 1991/03. He worked as Assistant Professor in Department of Physics, Saga University during 1996 - 2005 and at present he is a Professor in Department of Physics, Saga University.

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Zoran Borjan, Res. Rev. J Mat. Sci. 2018, Volume 6
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Primary scaling densities in the critical adsorption of Ising systems

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Critical adsorption of Ising systems in the presence of normal surface universality class is considered along the critical isochore, near coexistence and along the critical isotherm in cases of energy density and order-parameter and energy density, respectively. The problem is treated theoretically and by Monte-Carlo simulation method in spatial dimensions d=2, d=3 and theoretically in the mean-field limit. Excellent agreement between theory and the Monte-Carlo method is achieved within the study in d=3. Primary scaling densities such as order parameter and energy density manifest monotone behaviors with the relevant exception of non-monotone behaviors of energy density whenever an interface is present in systems. Two-dimensional analysis along the critical isotherm points to a new characteristic of low-dimensional Ising systems consisting of the interface de-localization. Above results are relevant to binary liquid mixtures, liquid-gas systems, ferromagnets, binary alloys and other physical systems of the Ising universality class near their corresponding critical points.

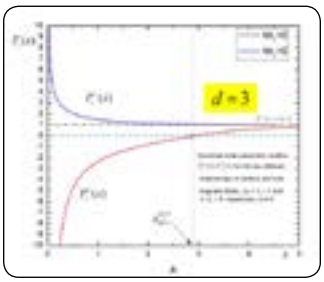

Figure 1: Universal order-parameter profiles along the critical isotherm near the surface of the standard normal universality class, Pc>(x) and Pc<(x) in cases hh1>0 and hh1<0, respectively, where h1=+∞ is the surface magnetic field, and h is the weak bulk magnetic field.

Recent Publications:

1. Borjan Z (2016) Critical Casimir effect in the Ising strips with standard normal and ordinary boundary conditions and the grain boundary. Physica A. 458:329-341.
2. Borjan Z (2015) Crossover aspects in Ising strips under the influence of variable surface fields and a grain boundary. Phys. Rev. E Stat. Nonlin. Soft Matter Phys. 91(3):032121.
3. P J Upton and Z Borjan (2013) Off-critical Casimir effect in Ising slabs with antisymmetric boundary conditions in d=3. Phys. Rev. B. 88:155418.

Biography

Zoran Borjan is an Associate Professor in Faculty of Physics, University of Belgrade and his works in the theory of phase transitions and critical phenomena. He uses continuum formulations in analysis of surface critical phenomena. Special emphasis is on the derivation of accurate results for systems of the Ising universality class in the experimentally most relevant spatial dimension d=3.

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Yong Zhang et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Properties of a weakly ionized NO gas sensor based on multi-walled carbon nanotubes

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Nitric oxide NO is one of the major targets for environmental monitoring and causes environmental and human health problems. Hence, it is of significant importance to measure NO concentrations in the air. However, the existing NO sensors are limited by their low sensitivity and narrow test range. Here, a weakly ionized NO gas sensor employing multiwalled carbon nanotubes (MWCNTs) was fabricated, and its properties in NO-N_2 mixture were investigated from both emission and ionization. The current Ie passing through the nanotubes cathode was found to decrease with increasing NO concentration and increase linearly in different slopes with the extracting voltage Ue. It is shown that the Schottky barrier of the MWCNTs calculated by Ie increased with NO concentration due to the adsorption of NO gas, which restrained the electron emission and consequently weakened the ionization. The positive ion currents Ic passing through the collecting electrode at different voltages of Ue were found to be monotonically decrease with increasing NO concentration which was induced by both of the reduced electron emission and the consumption of the two excited metastable states $N_2(A_3\Sigma u+)$ and $N_2(a'1\Sigma u-)$ by NO. The sensor exhibited high sensitivity at the low temperature of 30°C. The calculated conductivity was found to be able to take place of Ic for NO detection in a wide voltage range of 80-150V Ue.

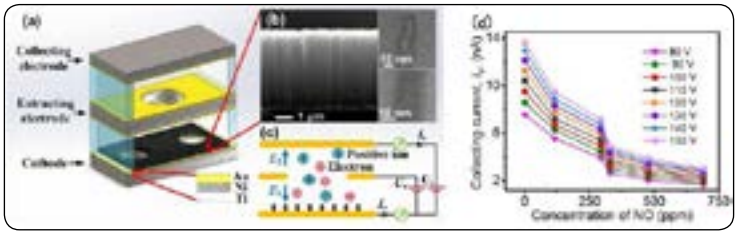

Figure 1: (a) The stucture of the sensor, (b) SEM and TEM of MWCNTs, (c) Schematic diagram of the test system, (d) Ic vs. NO concentrations at different Ue.

Recent Publications:

1. Zhang J Y et al. (2015) Properties of a weakly ionized NO gas sensor based on multi-walled carbon nanotubes. Applied Physics Letters. 107(9):093104-1-4.
2. Pan Z G et al. (2017) A high-integration sensor array sensitive to oxynitride mixture. Sensors and Actuators B Chemical. 245:183-188.
3. Pan Z G et al. (2017) Sensing properties of a novel temperature sensor based on field assisted thermal emission. Sensors. 17(3):473.
4. Zhang Y et al. (2013) High - performance gas sensors with temperature measurement. Scientific Reports. 3:1267-1-7.
5. Zhang Y, Liu J H and Zhu C C (2010) Novel gas ionization sensors using carbon nanotubes. Sensor Letters. 8(2):219-227.

Biography

Yong Zhang obtained his Bachelor's in Department of Electron, Master's in Department of Electron and Doctor Degree in Department of Measurement and Control Technology and Instrument from Xi'an Jiaotong University, respectively. She is a Professor in the School of Electrical Engineering of Xi'an Jiaotong University, a fixed Member of the State Key Lab of Electrical Institute and Power Equipment, a Senior Member of IEEE, and an expert Committee Member of Energy Equipment of China Energy Society. She has published 43 papers in international well-known publications (*Sensors and Actuators B: Chemical* of the Nature Publishing Group, *Sensors and Actuators B: Chemical* and so on). Twenty six of her patents have been authorized and 7 patents have been accepted by the Patent Office of China.

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Pushan Ayyub, Res. Rev. J Mat. Sci. 2018, Volume 6
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The microscopic origin of size-dependent lattice contraction and expansion

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With a decrease in the particle size, the lattice parameters in a large class of metallic nanoparticles (Ag, Al, Au, Cu, Ni, Pd, Pt, Bi, Sn, etc.) show a contraction as compared to their corresponding bulk values. Interestingly, among the metal nanoparticles listed above that exhibit a lattice contraction, all except Bi and Sn have a face centered cubic (fcc) crystal structure. The size dependence of the lattice parameter in fcc metals can be generally fitted to a Laplace-Young type equation, which suggests that they can be represented by a simple liquid-droplet model in which surface-tension-like forces are the most dominant. On the other hand, the few metals known to exhibit a systematic lattice expansion in the nanoparticle form include Cr, Fe, Nb, V and Ta, each of which happens to have a body centered cubic (bcc) structure. To understand the physical basis for this striking empirical correlation, we have carried out a detailed microscopic study based on *ab-initio* density functional theory (DFT). Our simulations on representative bcc (Nb) and fcc (Cu) nanoclusters elucidate the importance of a capping layer on the metal nanoparticles and succeed in provide a consistent understanding of this apparently puzzling observation. It is important to appreciate that size-driven changes in the lattice parameters is a non-trivial effect with significant consequences, in some cases dominating over quantum size effects and other types of surface effects. Thus, size-induced lattice expansion has been invoked to understand the (a) persistence of superconductivity down to unexpectedly small sizes, (b) appearance of a magnetic moment in isolated Fe atoms embedded in a nanocrystalline metals, and (c) destruction of ferroelectricity in nanocrystalline oxides.

Recent Publications:

1. D Nafday et al. (2018) A reduction in particle size generally causes body-centered-cubic metals to expand but face-centered-cubic metals to contract. ACS Nano. 12(7):7246-7252. Doi:10.1021/acsnano.8b03360.
2. S Sarkar et al. (2017) Is there a lower size limit for superconductivity? Nano Letters. 17:7027-7032.
3. S K Mohanta et al. (2016) Size-induced crossover from itinerant to localized magnetism observed for isolated Fe impurities embedded in different structural polymorphs of silver. Physical Review B. 94:184431.
4. S Chattopadhyay et al. (2015) Local structure, composition and crystallization mechanism of a model two-phase "composite nanoglass". J. Chemical Physics. 144(6):064503.
5. S Bose and P Ayyub (2014) A review of finite size effects in quasi-zero dimensional superconductors. Reports Progress Physics. 77(11):116503.

Biography

Pushan Ayyub is a Senior Professor and Chair in the Department of Condensed Matter Physics at the Tata Institute of Fundamental Research, Mumbai, India. He has over 160 publications in the general area of nanoscience. He was a Member of the International Committee on Nanostructured Materials (1998-2008) and is currently a Member of the Nano Mission Council of the Government of India. He is a Fellow of the Indian National Science Academy. His research interests include the size dependence of superconductivity and ferroelectricity. He is particularly interested in size-induced structural phase transitions and stabilization of novel crystal structures.

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Mohamed El Hafidi et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Magnetic properties of six-legs spin-S (S=½, 1) Ising nanotube under the effect of an external field

Mohamed El Hafidi, Z Elmaddahi and **M Y El Hafidi**
Hassan II University of Casablanca, Morocco

Over the last few years, magnetic nanoparticles (nanotubes and nanowires) have attracted the interest of experimental and theoretical researches owing to their quantum importance, surface boundary effects and their promising technological applications such as drug delivery, biomedicine, magnetic resonance (MRI), permanent magnets, long-lasting memories and recording media. In this work, we study a single-walled hexagonal spin-S (S=½ or 1) Ising nanotube on the basis of the effective-field theory (EFT) with correlations and the differential operator technique (DOT). In the six-leg spin nanotube, each spin is connected to its nearest-neighbors through exchange couplings both along the chains ($J_{//}$) and adjacent chains ($J_{\perp}$). Exact expressions for of magnetization, initial susceptibility, critical temperature are obtained as well as the ground phase diagram that is established for different exchange couplings. Some interesting phenomena are revealed, especially for opposite exchange interactions, magnetization plateaus and frustration are found.

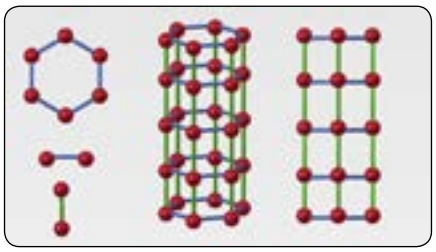

Fig.1: Schematic structure of the hexagonal spin nootube. (a) The red circles display the magnetic specie (S = 1) ions. The green and blue lines correspond respectively to the longitudinal exchange (J//) and transversal exchange ($J_{\perp}$) coupling paths . (b) Equivalent structure of the spin tube with the periodic boundary condition in the direction of rung (under the cyclic constraint α+6=α).

Recent Publications:

1. Z.ElMaddahi A.Farchakh M.Y.El Hafidi and M.El Hafidi. Magnetic and thermodynamic properties of a simple-wall hexagonal spin nanotube. Computational Condensed Matter. Volume 13, December 2017, Pages 77-82
2. Abeslam Farchakh, Mohamed El Hafidi, Contribution to Spin Tubes Study, Journal of Superconductivity and Novel Magnetism, May 2018, Volume 31, Issue 5, pp 1567–1575 in Journal of Superconductivity and Novel Magnetism (2018).

Biography

Mohamed El Hafidi is Professor of Quantum Physics and Magnetism at Hassan University II of Casablanca (Morocco) since 1985. He prepared a part of his PhD at the High Magnetic Field Laboratory (Grenoble, France) and he stayed as a visiting professor as a visiting professor at Joseph Fourier University of Grenoble. He currently supervises research on topological structures and low dimensionality magnetic systems.

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Golikova T E et al., Res. Rev. J Mat. Sci. 2018, Volume 6
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Nonlocal supercurrent in mesocopic multiterminal SNS Josephson junction

Golikova T E, Lvov D S, Egorov S V, Bobkova I V, Bobkov A M, Batov I E and **Ryazanov V V**
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A nonlocal supercurrent was observed in mesoscopic planar SNS Josephson junctions (Al-Cu-Al) with additional normal metal electrodes (Cu). Nonequilibrium quasiparticles were injected from a normal-metal electrode into the left superconducting bank of the Josephson junction in the absence of a net transport current through the junction. The value of nonlocal supercurrent slightly exceeds the local value I_c and depends on the distance between Josephson junction and the injector. The detected voltage in the resistive state in nonlocal configuration has opposite sign. We claim that the observed effect is due to a supercurrent counterflow, appearing to compensate for the quasiparticle flow in the SNS weak link. We have measured the responses of SNS junctions for different distances between the quasiparticle injector and the SNS junction at temperatures far below the superconducting transition temperature. Such a choice of the distance scale between injectors and Josephson junction allows us to exclude coherent CAR and EC effects. The charge-imbalance relaxation length was estimated by using a modified Kadin, Smith, and Skocpol scheme in the case of a planar geometry. The model developed allows us to describe the interplay of charge imbalance and Josephson effects in the nanoscale proximity system in detail at low temperatures (far below the superconducting transition temperature T_c).

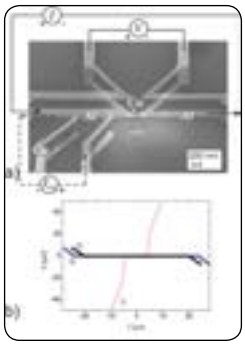

Figure 1. a) SEM image of an Al-Cu-Al multiterminal Josephson junction with two Cu injectors together with the measurement scheme (solid line - local, dashed line - nonlocal).**b)** Current-voltage characteristics of an Al-Cu-Al Josephson junction at 0.4 K . **1)** – local measurement; **2)** and **3)** – nonlocal measurements from the nearest and farest injectors correspondingly.

Recent Publications:

1. D Beckmann, H B Weber, and H V Löneysen (2004) Evidence for crossed Andreev reflection in superconductor ferromagnet hybrid structures. Phys. Rev. Lett. 93:197003
2. P Cadden Zimansky and V Chandrasekhar (2006) Non local correlations in normal metal superconducting systems. Phys. Rev. Lett. 97:237003.
3. A M Kadin, L N Smith, and W J Skocpol (1980) Charge imbalance waves and non equilibrium dynamics near a superconducting phase slip center. J. Low Temp. Phys. 38(3-4):497-534.
4. V K Kaplunenko, V V Ryazanov and V V Shmidt (1985) Effect of non equilibrium quasiparticle flow of SNS Josephson junctions. Journal of Experimental and Theoretical Physics. 89:1389-1403.

Biography

Golikova T E obtained her PhD Degree in Physics in 2014 and she is working on experimental investigation of the interplay of superconductivity and magnetism at low temperatures involving structure fabrication with the nanotechnology tools. Her research interest include: superconductivity and magnetism, spintronics, Josephson junctions.

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Chih Ming Lin, Res. Rev. J Mat. Sci. 2018, Volume 6
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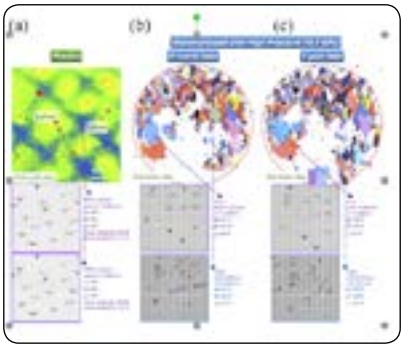
Synthesis of a stable HCP-FCC mixture phase of the high-entropy superalloys $Al_{0.15}Co_{0.18}Cr_{0.12}Fe_{0.11}Ni_{0.36}Ti_{0.08}$ at high pressure

Chih Ming Lin
National Tsing Hua University, Taiwan

High-entropy superalloys (HESA), $Al_{0.15}Co_{0.18}Cr_{0.12}Fe_{0.11}Ni_{0.36}Ti_{0.08}$, non-equimolar solid solutions of six elements, represent a new strategy for the design of materials with properties superior to those of conventional alloys. However, their phase space remains constrained, with transition metal high-entropy alloys containing FCC γ matrix with localized dispersion of L12 γ' particles. Here, we report the high-pressure synthesis of a stable HCP-FCC mixture phase of the prototypical high-entropy superalloys $Al_{0.15}Co_{0.18}Cr_{0.12}Fe_{0.11}Ni_{0.36}Ti_{0.08}$. This martensitic transformation begins at 0.55 GPa and is attributed to suppression of the local magnetic moments, destabilizing the initial FCC γ structure. However, the behaviour of $Al_{0.15}Co_{0.18}Cr_{0.12}Fe_{0.11}Ni_{0.36}Ti_{0.08}$ is unique in that the HCP phase is retained following decompression to ambient pressure, yielding a stable HCP-FCC mixture phase. This demonstrates a means of tuning the structures and properties of high-entropy superalloys in a manner not achievable by conventional processing techniques.



Recent Publications:

1. Lin CM et al. (2014) Pressure-induced structural phase transition in bulk $Zn_{0.98}Mn_{0.02}O$ by angular dispersive X-ray diffraction. J. Alloys and Compounds. 604C:298-303. Doi:10.1016/j.jaillcom.2014.03.055.
2. Lin C M et al. (2015) Pressure-Induced Phase Transitions in InAs studied by angular-dispersive x-ray diffraction and roman spectroscopy. Science of Advanced Materials. 7:1039-1044. Doi:10.1166/sam.2015.2174.
3. Huang J M et al. (2015) *In situ* Al-doped ZnO films by atomic layer deposition with an interrupted flow. Material Chemistry and Physics. 165:245-252. Doi:10.1016/j.matchemphys.2015.09.024.
4. Lin K L et al. (2016) Structural properties of pressure-induced structural phase transition of Si-doped GaAs by angular dispersive X-ray diffraction. Appl. Phys. A. 122(2):117. Doi:10.1007/s00339-016-9660-3.
5. Huang J M et al. (2016) Enhanced electrical properties and field emission characteristics of AZO/ZnO-nanowire core–shell structures. Phys. Chem. Chem. Phys. 18(22):15251-15259. Doi: 10.1038/s41598-018-19679-2.

Biography

Chih Ming Lin has his expertise in evaluation and passion in improving the health and wellbeing. Her open and contextual evaluation model based on responsive constructivists creates new pathways for improving healthcare. His research interest include: the physical properties of high-entropy alloys (HEAs) and Topological insulators (TIs) materials under high pressure and the process of synthesis of high-entropy alloys (HEAs) and Topological insulators (TIs) materials.

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