Rangeet Bhattacharyya

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Methodological development in Nuclear Magnetic Resonance and Quantum Information Processing

Our main interest is in developing novel experimental techniques in solid and liquid state NMR with primary interest lying in studying dynamics of liquid molecules and solids. Solid state NMR often shows signatures of non-linearity (departure from linear response theory), which, if taken into consideration, can provide wealth of information about the system under study. At the moment we are investigating the non-linear effects both from theoretical and experimental stand points. We also investigate the nature of decoherence and quantum evolution using coupled spin systems as model qubit network.

Selected Publications:

Diversity of carboxylate binding in a new tetranuclear zinc cluster: correlation between spectroscopic investigations and carboxylate binding modes, Patra, A., Sen T. K., Bhattacharyya , R., Mandal, S. K., and Bera, M., 2012, RSC Adv., 2, 1774

In situ NMR observation of the formation of metallic lithium microstructures in lithium batteries, Bhattacharyya, R., Key, B., Chen, H., Best, A. S., Hollenkamp, A. F., Grey, C. P., 2010, Nature Materials, 9, 504

Real-time NMR investigations of structural changes in silicon electrodes for lithium-ion batteries, Key, B., Bhattacharyya, R., Morcrette, M., Seznéc, V., Tarascon, J. M., Grey, C. P., 2009, Journal of the American Chemical Society, 131, 9239

Quadrupolar nuclear magnetic resonance spectroscopy in solids using frequency-swept echoing pulses, Bhattacharyya, R., Frydman, L., 2007, Journal of Chemical Physics, 127, 194503

Implementation of parallel search algorithms using spatial encoding by nuclear magnetic resonance, Bhattacharyya, R., Das, R., Ramanathan, K. V., Kumar, A., 2005, Physical Review A, 71, 052313

PhD Students:

Ipsita Chakraborty, Arnab Chakrabarti

Rangeet Bhattacharyya obtained his PhD in Physics from the Indian Institute of Science in 2005. Subsequently he was a postdoctoral fellow at Weizmann Institute of Science (Israel), Stony Brook University (USA) and at Southampton University (UK). Rangeet joined IISER Kolkata in 2010 and is serving as an Assistant Professor. He has received University Gold Medal from Jadavpur University and later Laura Marinelli award for his work on methodological developments in NMR in 2008.

Ananda Dasgupta

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Exploring the interface of physics and mathematics

The connection between physics and mathematics is an age-old one. Given the antiquity of this connection there seems to be little in store in terms of fundamental new themes to explore. However, the recent surge of interest in the techniques of Geometric Algebra and its connection to physics seems to show a great deal of promise. Ananda is fascinated by this rather recent rediscovery of old works by Grassmann and Clifford and is trying to adapt the technique to his area of expertise – which is the application of Lie algebraic techniques to study quantum phenomena. He is also deeply interested in physics pedagogy and is exploring the use of computer enabled methods in the teaching-learning process.

Selected Publications:

Gnuplot animations as a Physics teaching tool, Dasgupta A., 2012, Lat. Am. J. Phys. Educ., 6 , 252

Simple systematics in the energy eigenvalues of quantum anharmonic oscillators, Dasgupta A., Roy D., and Bhattacharya R., 2007, J. Phys. A: Math. Theor., 40, 773

A new look at two old problems in electrostatics, or much ado with hemispheres, Dasgupta A., 2007, Eur. J. Phys., 28, 705

Relativistic kinetics from the Bondi K-calculus, Dasgupta A., 2007, Eur. J. Phys., 28, 817

PhD Student:

Tapas Das

Ananda Dasgupta did his PhD work at the Saha Institute of Nuclear Physics, Kolkata. He obtained his PhD in Physics in 2001. He joined St. Xavier's College, Kolkata as a lecturer in Physics in 1999. In 2005 he joined the faculty of Jadavpur University and finally moved to IISER Kolkata in 2007.

Amitava Datta
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The Large Hadron Collider confronts physics beyond the Standard Model

The Large Hadron Collider (LHC) at CERN has produced a large volume of data during the last two years. No compelling evidence of physics beyond the standard model (SM) has been found. This constrains many theoretically well-motivated extensions of the SM. We have examined such constraints in the minimal supersymmetric SM (MSSM) which contains a viable candidate for the observed dark matter (DM) in the universe. We have argued that while the current LHC data at 7-8 TeV , severely constrains the strongly interacting sector of the MSSM, the electroweak sector is rather mildly constrained. On the other hand the electroweak sector by itself can produce the observed DM relic density. Thus supersymmetric DM is very much allowed by the LHC experiments. We are also working on the possible signatures of supersymmetric DM at the upgraded LHC experiments at 14 TeV which is expected to be operational in 2016.

Selected Publications:

Many Faces of Low Mass Neutralino Dark Matter in the Unconstrained MSSM, LHC Data and New Signals, Choudhury, Arghya, and Datta, Amitava, 2012, Journal of High Energy Physics, 1206, 006

Revealing the Footprints of Squark Gluino Production through Higgs Search Experiments at the Large Hadron Collider at 7 TeV and 14 TeV, Bhattacherjee, Biplob, and Datta, Amitava, 2012, Journal of High Energy Physics, 1203, 006

Enriching the Exploration of the mUED Model with Event Shape Variables at the CERN LHC, Datta, Amitava, Datta, Anindya, and Poddar, Sujoy, 2012, Physics Letters, B712, 219

Low Mass Neutralino Dark Matter in mSUGRA and More General Models in the Light of LHC Data, Bhattacharyya, Nabanita, Choudhury, Arghya, and Datta, Amitava, 2011, Physical Review, D84, 095006

Probing R-parity Violating Models of Neutrino Mass at the LHC via Top Squark Decays, Datta, Amitava, and Poddar, Sujoy, 2009, Physical Review, D79, 075021

PhD Students:

Sujoy Poddar, Nabanita Bhattacharyya, Arghya Choudhury

Amitava Datta obtained his PhD in Physics from Visva - Bharati University in 1977. Subsequently he joined Jadavpur University in 1981. He was a Fellow of the Alexander von Humboldt Foundation, an Associate Member of the International Centre for Theoretical Physics, Trieste. He has been a fellow of the Indian National Science Academy since 2004.

Rumi De
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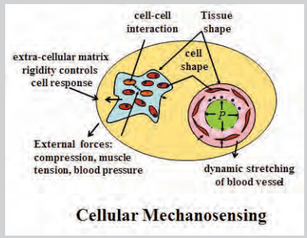
Physics of Living Matter

Our main interest is in theoretical biological physics specifically to understand the nonlinear dynamics and the mechano-sensitive behavior of active cells. Understanding the active response of cells to mechanical forces is important in the context of many biological processes -- such as wound healing, muscle growth, tissue organization and development -- that have wide implication in cell biology and even in biomedical applications. Some of the areas that we are interested in include cell adhesion, orientation, actin cytoskeletal dynamics, collective cell migration, fingering instability during wound healing, and other stretch induced cellular functionality and its consequences in embryonic development. We are also interested in stick-slip dynamics of living matter such as saltatory motion of white blood cells and actin dynamics. We study the underlying physics of the concerted active responses of the cell by using the approaches of statistical physics, soft condensed matter theory, theory of elasticity, and non linear dynamics. Our group is developing suitable theoretical models as well as carrying out simulations to understand the underlying dynamics of living system.



Cellular Mechanosensing

Selected Publications:

Mechanical consequences of cellular force generation, Zemel, A., De, R., and Safran, S. A., 2011, Curr. Opin. in Mat. Sci. Solid State Phys., 15, 169

Theoretical concepts and models of cellular mechanosensing, De, R., Zemel, A., and Safran, S., 2010, Methods in Cell Biology, 98, 143

Do cells sense stress or strain? Measurement of cellular orientation can provide a clue, De, R., Zemel, A., and Safran, S., 2008, Biophysical Journal Lett., 94, L29

Dynamics of cell orientation, De, R., Zemel, A., and Safran, S., 2007, Nature Physics, 3, 655 (Appeared in News and Views of Nature Physics)

Dynamics of the peel front and the nature of the acoustic emission during peeling of an adhesive tape, De. R., and Ananthakrishna, G., 2006, Physical Review Letters, 97, 165503

Dr. Rumi De obtained her PhD in 'Nonlinear Dynamical Systems' from the Indian Institute of Science in 2006. Subsequently she was a postdoctoral fellow at Weizmann Institute of Science in Israel and a postdoctoral research associate at Brown University in USA. She moved back to India and joined IISER Kolkata in 2010. She was a recipient of 'Young Investigator Award' at 6th World Congress of Biomechanics in Singapore in 2010.

Webpage: http://www.iiserkol.ac.in/people/faculty/dps/rumi-de

Amit Ghosal

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Interplay of electronic correlations and disorder: From quantum dots to superconductivity

Amit's research focuses on the understanding of the complex phases, in which the interplay of strong interactions and irregularities lead to new emergent phenomena. Some research being carried out in his group are:

(a) Melting of an amorphous solid ("Wigner molecules"), made out of Coulomb-interacting electrons, in an irregularly confined geometry. Melting driven by both the thermal and quantum fluctuations are being studied using advanced numerical techniques.

(b) The effect of impurities on high Tc cuprates. Much of their novel properties arise from the complex interplay of strong correlations between electrons and the doping. Amit is developing an inhomogeneous mean-field theory augmented with Gutzwiller techniques to uncover several interesting features of these systems.

(c) Disorder effects on the low Tc superconductors. The repulsion between electrons forming Cooper pairs has been typically neglected in the literature of disordered CS superconductors. On the other hand, such repulsion is known to produce local moments through the interplay with disorder. Amit hopes to uncover the roles of these moments in the demise of superconductivity.

Selected Publications:

Interaction-induced Strong Localization in Quantum Dots, Guclu, A. D., Ghosal, Amit, Umrigar, C.J., and Baranger, H.U., 2008, Physical Review B, 77, 41301(R)

Competing Ferromagnetism in the Overdoped High Temperature Copper Oxide Superconductors Kopp, A., Ghosal, Amit, and Chakravarty, S., 2007, Proceedings of the National Academy of Sciences, 104, 6123

Incipient Wigner Localization in Circular Quantum Dots, Ghosal, Amit, A.D. Guclu, A.D., Umrigar, C.J., Ullmo, D., and Baranger, H.U., 2007, Physical Review B, 76, 85341

Towards Strong Interaction in Circular Quantum Dots: Correlation Induced Inhomogeneity, Ghosal, Amit, A.D. Guclu, A.D., Umrigar, C.J., Ullmo, D., and Baranger, H.U., 2006, Nature Physics, 2, 336. (See also the Cover Story, *ibid.*).

PhD Students:

Dyuti Bhattacharya, Debmalya Chakraborty, Biswarup Ash

Amit Ghosal obtained his PhD in Physics in 2001 from the Tata Institute of Fundamental Research. Subsequently he was a Postdoctoral Fellow at McMaster University, funded by the SHARCNet Fellowship. He then moved to Duke University, USA with a Research Associate position. Finally, he spent two years at University of California, Los Angeles, USA as a Postdoctoral Scholar funded by the David Saxon Chair Fellowship.

Anandamohan Ghosh

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Nonlinear Dynamics; Mathematical and Theoretical Biology

I work on understanding the biological systems from a nonlinear dynamics and a statistical physics perspective. Dynamics of a neuron is highly non-linear and the methods of dynamical systems often reveal the underlying mechanism. Again, the emergence of the coherent behavior in a population of neurons can be studied using the tools of statistical physics. Identifying the features of the neural dynamics necessary for the emergent sensory adaptation is one of my present research interests. The mathematical analysis used in the above studies are quite generic in the sense that they can be used to study many biological systems. I also study the role of intrinsic noise in the transcription dynamics and how a cell responds and adapts to changes in the environment.

Selected Publications:

General properties of transcriptional time-series in Escheria coli, So, L., Ghosh, A., Zong, C., Sepulveda, L., Segev, R. and Golding, I., 2011, Nature Genetics, 43, 554

Phase description of spiking neuron networks with global electric and synaptic coupling, Roy, D., Ghosh, A. and Jirsa, V., 2011, Physical Review E, 83, 051909

Simple model for bursting dynamics of neurons, Ghosh, A., Roy, D. and Jirsa, V., 2009, Physical Review E, 80, 041930

PhD Student:

Soumen Kumar Patra

Anandamohan Ghosh obtained his PhD in Physics from National Chemical Laboratory, Pune in 2004.

Nirmalya Ghosh

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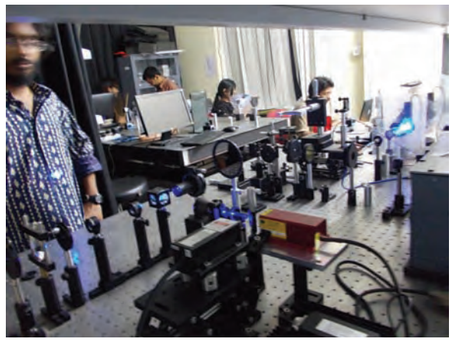
Biophotonics – Nano-Optics: Novel optical modalities for probing biological and other complex systems



Investigation of light-matter interactions at nano (or mesoscopic) scale has received considerable recent attention owing to fundamental interests and diverse potential applications. Nirmalya (and his group) investigates various aspects of light matter interaction and explores its applications in ultra-high sensitive sensing and optical nano-probing. These include studies on localized / surface plasmon resonances in metal nano-structures, plasmonic Fano resonances, spin orbit interaction of light in micro / nano systems, morphology dependent resonances (whispering gallery modes) in dielectric micro-particles, etc. The research activity of the group is also centered on developing novel optical imaging and spectroscopic modalities for probing biological and other complex systems. 'Random medium polarimetry' is the other actively pursued research area of the group. The studies involve (a) Development of novel polarimetry measurements / analysis methods (based on Jones, Stokes-Mueller formalisms) (b) Modeling polarized light transport (Monte Carlo simulations, radiative transport theory, diffusion approximation) in complex random medium and (c) explore its applications in biomedical diagnosis / imaging.

Selected Publications:

Probing multifractality in tissue refractive index: prospects for precancer detection, Das, N., Chatterjee, S., Soni, J., Jagtap, J., Pradhan, A., Sengupta, T.K., Panigrahi, P.K., Vitkin, I. A., and Ghosh, N., 2013, Optics Letters, 38, 211

Comparative study of differential matrix and extended polar decomposition formalisms for polarimetric characterization of complex tissue-like turbid media, Kumar, S., Purwar, H., Ossikovski, R., Vitkin, I. A., and Ghosh, N., 2012, Journal of Biomedical Optics, 17, 105006

Tissue polarimetry: concepts, challenges, applications and outlook, Ghosh, N. and Vitkin, I. A., 2011, Journal of Biomedical Optics, 16, 110801

Differing self-similarity in light scattering spectra: a potential tool for pre-cancer detection, Ghosh, S., Soni, J., Purwar, H., Jagtap, J., Pradhan, A., Ghosh, N., Panigrahi, P. K., 2011, Optics Express, 19, 19717

Quantitative polarimetry of plasmon resonant spheroidal metal nanoparticles: A Mueller matrix decomposition study, Soni, J., Purwar, H. and Ghosh, N., 2011, Optics Communications, 285, 1599

PhD Students:

Jalpa Soni, Nandan K. Das

Nirmalya Ghosh obtained his PhD in Physics from Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, India in 2006. Subsequently he was a postdoctoral fellow at Department of Medical Biophysics, University of Toronto, Canada. He has also held a position of Scientist at RRCAT, Department of Atomic Energy, India during the period 1998 – 2007. Nirmalya joined IISER Kolkata in 2009.

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Golam Mortuza Hossain

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The quantum universe at the Planck scale and its implications at large scale

General relativity is an amazingly successful theory of gravitation. However, it predicts existence of singularities in regions of extreme densities where it becomes unreliable. It is believed that a suitable reconciliation of general relativity with quantum theory, another tenet of modern physics, is needed to address this issue. The quest for a "quantum theory of gravity" which is expected to supersede general relativity in describing physics near extreme gravitational situations has led to several approaches. Golam's research interests concern primarily in the field of the so-called Loop Quantum Cosmology which is a mini-superspace approach using techniques of Loop Quantum Gravity, a proposed theory of quantum gravity. The quantization method used in this theory is often referred as polymer or loop quantization. Recently Golam has been exploring the physical implications of polymer quantization of matter fields.

Selected Publications:

Primordial polymer perturbations, Seahra, S. S., Brown, I. A., Hossain, G. M., and Husain, V., 2012, Journal of Cosmology and Astroparticle Physics, 1210, 041

The Propagator in polymer quantum field theory, Hossain, G. M., Husain, V., and Seahra, S. S., 2010, Physical Review D, 82, 124032

Loop quantum gravity corrections to gravitational wave dispersion, Bojowald, M., and Hossain, G. M., 2008, Physical Review D, 77, 023508

Genericness of a Big Bounce in Isotropic Loop Quantum Cosmology, Date, G., and Hossain, G. M., 2005, Physical Review Letters, 94, 011302

Primordial density perturbation in effective loop quantum cosmology, Hossain, G. M., 2005, Classical and Quantum Gravity, 22, 2511

PhD Student:

Gopal Chandra Sardar

Golam Mortuza Hossain obtained his PhD in Theoretical Physics from the Institute of Mathematical Sciences, Chennai in 2006. Subsequently he was a postdoctoral fellow at the Institute for Gravitation and the Cosmos, Pennsylvania State University and University of New Brunswick, Canada. He was awarded INSA Medal for Young Scientists in 2006. Golam moved back to India in 2010 to join IISER Kolkata as an Assistant Professor.

Pradip Khatua
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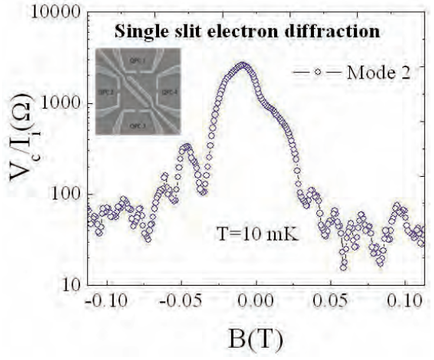
Mesoscopic physics in semiconductor at ultra-low temperature



Variation of detector signal with magnetic field. The curve is the electronic analog of single slit diffraction in optics.

Many interesting and sometimes unexpected effects appear due to the phase coherence of electronic wave-functions in the mesoscopic regime. Some of these effects are very promising for applications in nano-electronic devices. Mesoscopic system, on the other hand, provides a possibility to understand the basic features of quantum mechanics in a very controlled way. Currently, I am working on one such problem, where electronic phase coherence plays a very crucial role, the phenomenon called electron diffraction (a thought experiment of Feynman), using high mobility two dimensional electron gas at 10 mK temperature. I have also been studying weak localization (WL) and universal conductance fluctuations (UCF) through magneto-transport measurements on silicon nano-wires at very low temperature, where quantum interference plays a key role to understand the process of de-coherence caused by electron-electron interaction. The feasibility of one parameter scaling theory in such low dimensional quantum wires is also under investigation.

Selected Publications:

Indigenous design and fabrication of a 6.5 tesla superconducting magnet and a magneto-transport measurement set-up, Khatua P., and Majumdar, A. K., 2009, Pramana, 72, 629

Competition between interlayer exchange and Zeeman energies on the way to saturation of magnetization in Fe/Cr multilayers, Khatua, P., and Majumdar, A. K., 2009, Journal of Applied Physics, 105, 013920

Correlation between giant magnetoresistance and anomalous Hall effect: A realization of the existence of quantum well in giant magnetoresistive Fe/Cr multilayers, Khatua, P., and Majumdar, A. K., 2006, Physical Review B, 74, 092405

Scaling law and its universality in the anomalous Hall effect of giant magnetoresistive Fe/Cr multilayers, Khatua, P., Majumdar, A. K., Temple, D., and Pace, C., 2006, Physical Review B, 73, 094421

Pradip Khatua obtained his PhD in Physics from the Indian Institute of Technology Kanpur in 2006. Subsequently he was a postdoctoral fellow at Weizman Institute of Science, Israel.

Uday Kumar
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Experimental Condensed Matter Physics & Spectroscopy: Magnetism, superconductivity, transport properties and spectroscopy

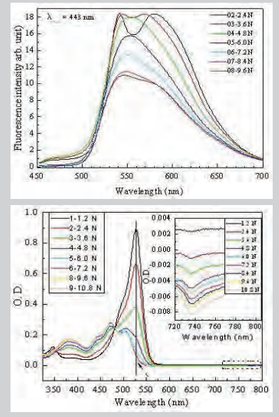
We basically study Magnetic mechanism in bulk and low dimensional systems (Intermetalic alloys, oxides etc.) which do include nanomaterials too. Phase transition and criticality are important aspects to be studied.

In superconductivity, we are basically focusing on magnetic mechanism of superconductivity and sample is being prepared by chemical route. Organic superconductor is our one of the recent interest in which mechanism looks to be very interesting due to localized nature of electron.

Transport property of strongly correlated systems is very interesting due to complicated nature of basic mechanism.

Spectroscopy of organic molecules and low dimensional systems (quantum dots) is our interest. The dynamics of coupled system (quantum dot and organic molecule) is quit fascinating. Recently we observed Fano resonance with organic laser dye which is quite novel results.

More importantly, we are developing high magnetic filed pulse magnet a state of the art facility for the study of magnetoresistance (MR) and photoluminescence with Dr. Bhavtosh Bansal and Dr. Pradip Khatua. As the first stage of development, the highest pulse magnetic field achieved is 22 Tesla with working temperature range for MR measurement from room temperature down to liquid nitrogen.



The graphic shows one of the most fascinating phenomena of Fano Resonance in absorption and fluorescence spectra of Rhodamine-6G laser dye in the aqueous medium with relative change in the hydrochloric acid concentration

Selected Publications:

Glassy behaviorinthelayeredperovskites$La_{(2-x)}Sr_xCoO_4$ (1:1⩽x⩽1:3), Mukherjee, S., Mukherjee, Rajarshi, Banerjee, S., Ranganathan, R., and Kumar, Uday, 2012, Journal of Magnetism and Magnetic Materials, 324, 928

Efficient lasing action from Rhodamine-110 (Rh-110) impregnated sol–gel silica samples prepared by dip method, Deshpande, Aparna V., and Kumar, Uday, 2010, Journal of Luminescence 130, 839

An automated autocorrelator for the measurement of high-frequency femtosecond pulses, Benocc, R., Batani, D., Jawad, H., Carpeggiani, P., Kumar, Uday, Levchenko, A., Venkatakrishanan, N., 2010, Radiation Effects & Defects in Solids, 165, 681

Effect of higher protonation on lasing performance of Rhodamine-B in sol-gel glasses, Deshpande, A. V., and Kumar, Uday, 2009, Journal of Non-Crystalline Solids, 355, 501

(Invited Book Chapter) Kumar, Uday, In: "The Sol-Gel Process: Uniformity, Polymers and Applications"; Editors: Rachel E. Morris; Sol-Gel based solid state dye-laser—Past, Present and Future, Nova Science Publishers 2010, ISBN: 978-1-61761-321-0

Uday Kumar obtained his PhD in Physics from the Institute of Chemical Technology, University of Mumbai in 2003. Subsequently he was a Research Associate at S. N. Bose National Centre for Basic Sciences, Kolkata, India and a visiting scientist at Milano Biccoca University, Itally. Uday Kumar moved back to India in IISER Kolkata in July 2007 as Senior Scientiffic Officer.

Arindam Kundagrami
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Physics of soft matter: Liquid crystals to charged polymers

My research interests centre on soft condensed matter physics which uses the language and tools of statistical physics. Soft matter physics deals with soft materials like colloids, liquid crystals, polymers, and complex fluids that are “soft” to touch as their elastic modulus is much lower compared to “hard” materials. Soft materials provide an ideal testing ground for many fundamental ideas of physics such as the relation between elasticity, long-wavelength dynamics, topological defects and broken symmetry, critical phase behaviour, and cooperative phenomena and self assembly of particles.

The major topics currently I am working on include equilibrium phase behaviour of polyelectrolytes (charged polymers) in diverse forms (such as isolated ionizable polymers, gels, brushes, or semi-flexible polymers), various phenomena in polymer physics (such as polymer complex formation, coil-globule transition, and stability of novel phases (e.g.,"pearl-necklace" phase), dynamics of phase transitions (such as swelling in polyelectrolyte gels), moving boundary problems in diffusive systems, and its application to soft-matter and biological processes.

The “pearl-necklace” phase of a single charged polymer chain

Selected Publications:

Effective charge and coil-globule transition of a polyelectrolyte chain, Kundagrami, A., and Muthukumar, M., 2010, Macromolecules, 43, 2574

Charge regularization in phase separating polyelectrolyte solutions, Muthukumar, M., Hua, J., and Kundagrami, A.,2010, The Journal of Chemical Physics, 132, 084901

The collapse of linear polyelectrolyte chains in a poor solvent: When does a collapsing polyelectrolyte collect its counter ions?, Loh, P.,Deen, R.,Vollmer, D., Fischer, K., Schmidt, M., Kundagrami, A., and Muthukumar, M., 2008, Macromolecules, 41, 9352

Theory of competitive counterion adsorption on flexible polyelectrolytes : Divalent salts, Kundagrami, A., and Muthukumar, M., 2008, The Journal of Chemical Physics, 128, 244901

The Structure of twist-grain-boundary-C Phases, Kundagrami, A., and Lubensky., T., 2003, Physical Review E (Rapid Communications), 68, 060703

PhD Student:

Swati Sen

After doing his B.Sc. from Presidency College, Kolkata, and M.S. from IISc, Bangalore, Arindam worked with Tom Lubensky on phase behaviours of smectic liquid crystals during his Ph.D from University of Pennsylvania (2003). In his only postdoctoral job with M. Muthukumar in University of Massachusetts, Amherst, he worked on the physics of charged polymers. Additionally, Arindam had been a consultant from UMass to Johnson & Johnson. Arindam joined DPS, IISER Kolkata in 2010.

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Siddhartha Lal
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Less is Different: Emergence of complexity in low-dimensional quantum systems

Lowered dimensionality, strong correlations and quantum fluctuations often conspire to give rise to novel emergent states of matter in quantum condensed matter systems. Emergence refers to the complex behaviour of a many-body system that is qualitatively different from that of its constituent parts. The theoretical analysis of such phenomena is made challenging by the lack of any obvious small coupling constant in the problem. In addition, critical phenomena in low-dimensional systems are often at zero-temperature and driven by quantum fluctuations arising from the competition between different quantum orders. Siddhartha has investigated emergent phenomena in a variety of systems, including those that display the quantum Hall effect, superconductivity at high temperatures and orbital-spin liquid states. He is also keenly interested in understanding how correlations and connectivity modify our understanding of circuitry at the quantum level. As a condensed matter theorist, he hopes that uncovering the mechanisms responsible for such emergent phenomena can provide proof-of-concept demonstrations that impact future quantum technologies.

Selected Publications:

Charge Fractionalisation in a Mesoscopic Ring, deGottardi, W., Lal, S., and Vishveshwara, S., 2013, Phys. Rev. Lett., 110, 026402

Inelastic light scattering measurements of a pressure-induced quantum liquid in $KCuF_3$, Yuan, S., Kim, M., Seeley, J. T., Lee, J. C. T., Lal, S., Abbamonte, P., and Cooper, S. L., 2012, Phys. Rev. Lett., 109, 217402

Two-step stabilization of orbital order and the dynamical frustration of spin in the model charge-transfer insulator $KCuF_3$, Lee, J. C. T., Yuan, S., Lal, S., Joe, Y. I., Gan, Y., Smadici, S., Finkelstein, K., Feng, Y., Rusydi, A., Goldbart, P. M., Cooper, S. L., Abbamonte, P., 2012, Nature Physics, 8, 63

Andreev Bound State Spectroscopy in a Graphene Quantum Dot, Dirks, T., Hughes, T. L., Lal, S., Uchoa, B., Chen, Yung-Fu, Chialvo, C., Goldbart, P. M., Mason, N., 2011, Nature Physics, 7, 386

Charge-Density-Wave and Superconductor Competition in Stripe Phases of High Temperature Superconductors, Jaefari, A., Lal S., and Fradkin, E., 2010, Phys. Rev. B, 82, 144531

PhD Students:

Nivedita Bhadra, Dinesh Sarkar

Siddhartha Lal obtained his Ph.D. in Physics from the Indian Institute of Science, Bangalore in 2003. With postdoctoral tenures at the Institute for Theoretical Physics (University of Cologne), the Abdus Salam International Center for Theoretical Physics (Trieste) and the Institute for Condensed Matter Theory at the University of Illinois at Urbana-Champaign, he joined the Indian Institute for Science Education and Research, Kolkata as an Assistant Professor in July 2010. He started his Ramanujan Fellowship in December 2010.

Chiranjib Mitra
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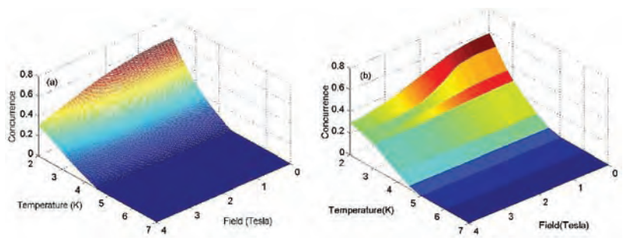
Physics of correlated electron systems

I work on Strongly Correlated Electron systems, probing certain aspects of Magnetism and Transport in localized moments as well as itinerant electron moments based compounds, which include both intermetallic and oxide compounds in addition to some molecular magnets, which are essentially low-dimensional systems. I study Kondo Lattices (Heavy Fermions), dilute Kondo Systems, Non-Fermi liquid like behavior in the localized moment systems where as doped manganites and spin polarized tunneling in granular materials as well as artificially fabricated tunnel junctions in the itinerant moment magnetic systems. In the molecular magnets, I am interested in studying low dimensional, low spin systems where the system will behave like quantum mechanical system at low temperatures and the ensuing spin system will be like a Heisenberg chain. One can probe the quantum nature of the ground state in an antiferromagnetic ground state; the system will be in an entangled state. This entangled nature of the ground state can be used in Quantum Information Processing and quantum communication through spin chains. In addition to these I also work on Topological Insulators, where, the surface is conducting but the bulk is insulating. These surface states are topologically protected and can be used to encode quantum information, which is resistant to decoherence and can be used for fault tolerant quantum computation.



Theoretical value of concurrence as a function of magnetic field and temperature for a dimer model. (b) Experimental value of concurrence as a function of magnetic field and temperature for $Cu(NO_3)_2$ x 2.5 H_2O. The magnetic field values are in Tesla and the temperature is in Kelvin.

Selected Publications:

Experimental detection of quantum information sharing and its quantification in quantum spin systems, Das, D., Singh, H., Chakraborty, T., Gopal, R. K., and Mitra C., 2013, New Journal of Physics, 15, 013047

Quantification of entanglement from magnetic susceptibility for a Heisenberg spin 1/2 system, Chakraborty, T., Singh, H., Das, D., Sen, T.K., and Mitra, C., 2012, Physics Letters A, 376, 2967

Teleportation in the presence of common bath decoherence at the transmitting station, Rao D.D.B., Panigrahi P.K., Mitra C., 2008, Physical Review A, 78, 022336

Molecular thin films: A new type of magnetic switch; Heutz S., Mitra C., Wu W., Fisher A.J., Kerridge A., Stoneham A.M., Harker A.H., 2007, Advanced Materials, 19, 3618

Observation of Minority Spin Character of the New Electron Doped Manganite La0.7Ce0.3 MnO3 from Tunneling Magnetoresistance, Mitra, C., Raychaudhuri, P., Dörr, K., Müller, K.H., Schultz, L., Oppeneer, P.M., Wirth, S., 2003, Physical Review letters, 90, 17202

PhD Students:

Harkirat Singh, Tanmoy Chakraborty, Radha Krishna Gopal, Sourabh Singh, Jit Sarkar

Chiranjib Mitra did his PhD in Physics from the Tata Institute of Fundamental Research, Mumbai, India in 2001. Before moving to IISER Kolkata in 2007, he was a postdoctoral fellow jointly at the Max Planck Institute for the Chemical Physics of Solids, Dresden, Germany and Institut für Festkörper-und Werkstofforschung Dresden, Germany (2001-2002), University of Cambridge, Cambridge, U.K. (2002-2004) and London Centre for Nanotechnology, University College London, U.K. (2004-2007).

Partha Mitra
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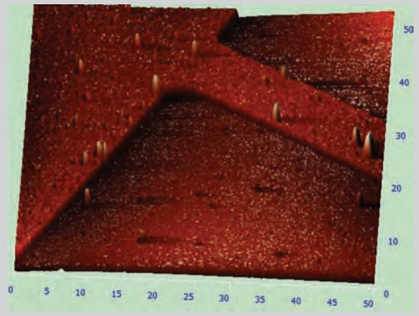
Spin dependent transport phenomenon and application

The signatures of the spin degree of freedom of the free carriers in a solid material often get masked by the large classical electromagnetic forces on its charge and also due to 'relaxation' effect that makes spin current non conservative. With the recent advancement in nanotechnology and ultra fast measurement techniques, it is now possible to design novel experimental schemes to overcome these challenges. This has led to a very active multidisciplinary field of research that aims at understanding the fundamentals of the spin dependent transport phenomenon that can eventually find application in the form of 'spintronic' devices.



A lithographically patterned topological insulator film imaged by Atomic Force Microscope

Our group explores wide range of materials with potential for spintronic applications due to longer spin coherence lengths and spin-orbit interaction. Currently we are investigating new classes of radical based organic semiconductors and topological insulators for quantum effects in transport properties using our low temperature and high magnetic field facility. Subsequently we aim to use these materials to attempt several challenges like electrical detection of spin hall effect, detection of spin currents using superconductive and ferromagnetic interfaces and manipulation of nanomagnets using spin torque. We have developed state-of-the -art facilities for synthesis of the thin films and multilayer samples and fabrication of nano and micro devices.

Selected Publications:

Magnetic ordering in Ni-rich NiMn alloys around multicritical point: Experiment and theory, Pal, P., Banerjee, R., Banerjee, R., Mookerjee, A., Khaple, G. C., Sanyal, B., Hellsvik, J., Eriksson, O., Mitra, P., Majumdar, A. K., and Nigam, A.K., 2012, Physical Review B, 85, 174405

Magnetostructural studies on tetranuclear Manganese [$Mn^{III}_2Mn^{II}_2$] complexes of 9-Hydroxyphenalenone with Weak π···π Interactions, Dey, K., Honecker, A., Mitra, P., Mandal, S. K., and Mukherjee, A., 2012, European Journal of Inorganic Chemistry , 35, 5814

Quasi-reversible magnetoresistance in exchange-spring tunnel junctions, Zhu, M., Wilson, M. J., Mitra, P., Schiffer, P., and Samarth, N., 2008, Physical Review B, 78, 195307

Spin valve effect in self exchanged biased ferromagnetic metal/semiconductor bilayers, Zhu, M., Wilson, M. J., Sheu, B. L., Mitra, P., Schiffer P., and Samarth, N., 2007, Applied Physics Letters, 91, 192503

Weak localization correction to the anomalous Hall effect in polycrystalline Fe films, Mitra, P., Misra, R., Hebard, A. F., Muttalib, K. A., and Woelfle, P., 2007, Physical Review Letters, 99, 046804

PhD Student:

Arpita Mandal

Dr Mitra pursued graduate studies at the University of Florida and obtained Doctoral degree in Physics in May 2006 for his thesis on experiments done on ultra thin films of magnetic materials at low temperatures. He continued postdoctoral research in the field of semiconductor spintronics at The Pennsylvania State University from 2006-2009. Subsequently, he joined IISER-Kolkata in 2009.

Goutam Dev Mukherjee

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Studies at extreme conditions of pressure

Experimental investigations of condensed states generally deal with studying their physical properties by changing the physical parameters, like, pressure, temperature, and magnetic field. Suitable theoretical models are then used for analytical and computational studies to understand the fundamental mechanisms responsible for the unique physical properties exhibited by the condensed states of matter. Among all the physical parameters, pressure perhaps has the greatest range. Applying external pressure one can tune the interatomic spacing of any material by considerable amount with a very high precision. This can produce new high density phases of matter with novel physical properties, like, novel-superconductivity, multiferroic-behaviour, re-entrant ferroelectricity, collapse of magnetism etc. In this large canvas, strongly correlated-electron systems provide us with very unique and interesting problems, most of which are not understood yet. We squeeze our specimens under (quasai-)hydrostatic conditions using diamond anvil cells to pressures above 150 GPa and study their response using different spectroscopic techniques and also X-ray diffraction measurements in synchrotron sources. We also study the electrical transport behavior under pressure to complement the above optical and structural investigations.

Selected Publications:

Reappearance of Ferroelectric Soft Modes in the Paraelectric Phase of Pb1-xCaxTiO3 at High Pressures: Raman and x-ray diffraction studies, Basu A., Chandra A., Tyagi A.K., and Mukherjee G. D., 2012, Journal of Physics: Condensed Matter, 24, 115404

High Pressure Investigations of Na0.025WO3: X-ray diffraction and Raman spectroscopy studie, Basu, A., Paul, S., Pollentarutti, M., Bais, G., Oishi, S., Raj, S., and Mukherjee, G. D., 2011, Journal of Physics: Condensed Matter, 23, 365401

High Pressure Melting Curve of He and Ne: Deviations from theory of corresponding states, Santamaria-Perez, D., Mukherjee, G. D., Schwager, B. and Boehler, R., 2010, Physical Review. B, 81, 214101

X-ray Diffraction Measurements of Mo Melting to 119 GPa and the High Pressure Phase Diagram, Santamaria Perez, D., Ross, M., Errandonea, D., Mukherjee, G. D., Mezouar, M., and Boehler, R., 2009, Journal of Chemical Physics, 130, 124509

High Pressure Melting Curve of Nitrogen and Liquid-Liquid Phase Transition, Mukherjee, G. D., and Boehler, R., 2007, Physical Review Letter, 99, 225701

PhD Students:

Abhisek Basu, Rajesh Jana, Guruprasad Mandal, Susanta Das

Goutam Dev Mukherjee obtained his PhD in Physics from the University of Hyderabad in 1997. Subsequently he was a postdoctoral fellow in IIT Kanpur, Scientist D and E in Bhabha Atomic Research Centre, and visiting scientist in High Pressure Group, Max Plank Institute for Chemistry in Mainz. He has received the N.S. Satyamurthy Best Young Scientist Award in 2002 from Indian Physics Association and 3rd best prize in the Young Scientist Colloquium in 2000 from Indian Physical Society. He is also recipient of Senior Fulbright Fellowship and visited Harvard University to work on high pressure investigations in hydrogen. He joined IISER Kolkata in 2008.

Dhananjay Nandi

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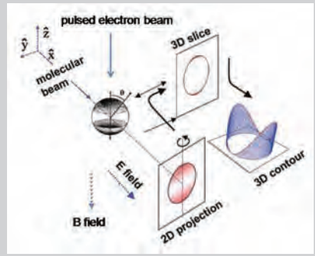
Gas Phase Molecular Dynamics: Low energy electron-molecule collisions

The main interest of Dhananjay is to understand the detailed gas phase molecular dynamics probed by *novel* Velocity Map Imaging (VMI) technique with Time Slicing (see accompanying figure). This includes fundamental aspects of electron attachment phenomena and dissociation dynamics in isolated molecules and clusters. The low energy electron interacts with molecule forming transient molecular anion that subsequently dissociates into fragment anion and neutrals (DEA). Dhananjay is developing a custom design VMI spectrometer for the studies of Dissociative Electron Attachment (DEA) and Polar Dissociation (PD). VMI is a recent variant of charge particle imaging, the heart of the spectrometer is a two dimensional Position Sensitive Detector (PSD). From the time and position information one can extract all three momentum component enabling kinematically complete measurement. From the time sliced image one can determine the kinetic energy and the angular distribution with unprecedented sensitivity.



This figure shows the schematic of the velocity map imaging for low energy electron-molecule collision

Selected Publications:

Dissociative electron attachment to NO probed by Velocity Map Imaging, Nandi, D., Prabhudesai, V. S., Nestman, B. M., and Krishnakumar, E., 2011, Phys. Chem. Chem. Phys., 13, 1542

Photoionization of 2-Pyridone and 2-Hydroxypyridine, Poully, J. C., Schermann, J. P., Nieuwjaer, N., Lecomte, F., Grégoire, G., Desfrançois, C., Garcia,G. A., Nahon, L., Nandi, D., Poisson, L., and Hochlaf, M., 2010, Phys. Chem. Chem. Phys., 12, 3566

Dissociative Electron Attachment to Poly-atomic Molecules: Ion Kinetic Energy Measurements, Nandi, D., and Krishnakumar, E., 2010, Int. J. Mass Spectrom., 289, 39

PhD Students:

Pamir Nag, Atanu Nandy

Dhananjay Nandi obtained his PhD in Physics from the Tata Institute of Fundamental Research in 2004. Following this he was postdoctoral fellow at Max-Planck-Institüt für Kernphysik, Heidelberg, Germany; Guest Scientist at Freie Universität, Berlin, Germany; Research Professor at Seoul National University, Korea; and Research Associate at Laboratoire Francis PERRIN, CEA Saclay, France. Dhananjay received INSA Medal for Young Scientist in 2010.

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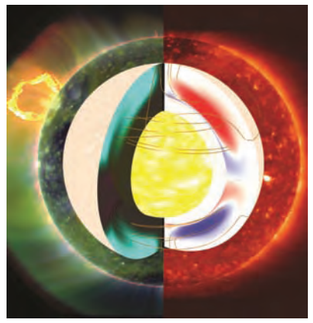
Astrophysical Space Sciences: Exploring the Sun-Earth system



This collage shows magnetic fields in the interior of the Sun simulated using a solar dynamo model (center) and the observed solar corona at two different phases of solar activity; a quiescent phase during the recent, unusually long minimum in solar activity (right) and a comparatively active phase following the minimum (left) – during which a solar storm is seen to originate (upper-left corner). The dynamo simulated toroidal and poloidal components of the Sun's magnetic field are depicted in color within the Sun in this image. Sunspots originate from this internal magnetic field and are the seats of solar storms that generate beautiful auroras but are also hazardous to our space-based technologies. This simulation is from Nandy et al. 2011 (Nature, 3rd March issue)

The Sun is a variable star, with its radiative, magnetic and particulate output varying on timescales ranging from minutes to planetary evolutionary timescales. The short term variability is primarily manifested through solar magnetic storms which contribute to severe space weather affecting space-based technologies. The long term solar radiative variability, which is coupled to the Sun's magnetic output, is the primary natural driver of the Earth's climate system. This rich diversity of solar activity ultimately originates in a magnetohydrodynamic dynamo mechanism in the solar interior that generates magnetic fields feeding on solar plasma flows. Dibyendu explores this Sun-Earth system – through dynamo simulations of solar magnetic fields, developing theoretical and satellite data analysis-based techniques for severe space weather forecasting, and investigating the solar contribution to global climate change. Dibyendu leads the MHRD Center of Excellence in Space Sciences, is involved with India's first solar space mission, holds vice-chairmanship of the space weather panel of the international Committee on Space Research and is a working group chairman of the International Astronomical Union.

Selected Publications:

Kinematic Properties of Solar Coronal Mass Ejections: Correction for Projection Effects in Catalogued Satellite Measurements, Howard, T.A., Nandy, D., and Koepke, A., 2008, Journal of Geophysical Research, 113, A01104

The Unusual Minimum of Solar Cycle 23 Caused by Changes in the Sun's Meridional Plasma Flows, Nandy, D., Munoz-Jaramillo, A., & Martens, P.C.H. 2011, Nature, 471, 80

Space Climate, Editors: Mursula, K., Usoskin, I., Nandy, D, and Marsh, D. 2011, a special issue of the Journal of Atmospheric and Solar-Terrestrial Physics, Elsevier (Amsterdam), Volume 73, Issues 2-3

Modeling the Solar Cycle: What the Future Holds, Nandy, D. 2012, in the book "Comparative Magnetic Minima: Characterizing quiet times in the Sun and Stars", Cambridge University Press, page 54, ISBN-13: 9781107019867

Turbulent Pumping of Magnetic Flux Reduces Solar Cycle Memory and thus Impacts Predictability of the Sun's Activity, Karak, B.B., and Nandy, D., 2012, Astrophysical Journal Letters, 761, L13

PhD Students:

Antonia Wilmot-Smith, Anthony Yeates, Andres Munoz-Jaramillo, Dario Passos, Soumitra Hazra

Dibyendu obtained his PhD in Physics in 2003 from IISc following which he was Postdoctoral Fellow and Assistant Research Professor at Montana State University and a Visiting Scientist at Harvard-Smithsonian Center for Astrophysics. He moved back to India in 2008. Dibyendu's honours include the Martin Forster Gold Medal from IISc, the Ramanujan Fellowship of the Government of India and the Harvey Prize of the American Astronomical Society.
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Rajesh Kumble Nayak

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Black holes and gravitational waves

Almost all the studies on blackholes have focused on isolated blackholes possessing two basic properties, namely time-independence and asymptotic flatness. On the other hand, one cannot rule out the important and, perhaps, realistic situation in which the black hole is associated with a non-flat background. Very little has been done in this direction. We investigate the physical effects near asymptotically non-flat blackholes.

Breakthroughs in modern technology have made possible the construction of extremely large interferometers both on ground and in space for the detection and observation of gravitational waves. Several ground based detectors are being constructed around the globe; these are the projects, LIGO, VIRGO, GEO, TAMA and AIGO of building interferometers whose arm-lengths will be of the order of kilometers. LISA - Laser Interferometric Space Antenna - is a proposed mission consisting of three identical spacecrafts forming a giant equilateral triangle of side 5 Million kilometers to observe and detect low frequency cosmic gravitational waves. Data analysis is an important component of gravitational wave detection, we develop and implement various algorithms for identifying and analyzing astrophysical gravitational wave signatures from the detectors output.

Selected Publications:

Inertial forces and Einstein's Equations in axially symmetric stationary spacetimes, Nayak, K. Rajesh, 2009, Gen. Rel. and Gravitation, 1572-9532 (Online)

General relativistic treatment of LISA optical links, Dhurandhar, S. V., Vinet, J-Y., and Nayak, K. Rajesh, 2008, Class. Quantum Grav. 25, 245002

The tomographic method for LISA binaries: application to MLDC data, Nayak, K. Rajesh, Mohanty, Soumya D., and Hayama, Kazuhiro, 2007, Class. Quantum Grav. 24, S587

On the minimum flexing of LISA's arms, Nayak, K. Rajesh, Koshti, S., Dhurandhar, S. V., and Vinet, J-Y., 2006, Class. Quantum Grav., 23, 1763

Tomographic reconstruction of LISA Galactic binary distribution, Mohanty, Soumya D., and Nayak, K. Rajesh, 2006, Phys. Rev. D, 73, 083006

PhD Students:

Basabendu Barman, Santanu Tripathy

Dr Rajesh Nayak obtained his PhD in Physics in 2002 from the Indian Institute of Astrophsyics, Banglaore. He was a Postdoctoral Fellow at IUCAA and Pune and Henri Poincare post doctoral Fellow at Observatoire de la Cote d'Azur, Nice France. Following this he was a Postdoctoral Fellow at Center for Gravitational Wave Astronomy, Dept. Physics and Astronomy, University of Texas At Brownsville.

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Nanoscience in femtosecond domain: Probing nanomaterials with ultrafast laser spectroscopy

A PhD student is working on time-resolved spectroscopy setup using femtosecond laser system in the laboratory

Probing science at the extreme length and time scales has been a never ending endeavor of human society. At one extreme, there is astrophysical research involving stars and galaxies and on the other end lies the 'small is beautiful' domain of nanoscience and ultrafast phenomena. Bipul is fascinated by the 'ultra-small – ultra-fast' world of semiconductor nanostructures. His research involves study of interactions of electrons and holes with phonons, defects and disorder in semiconductors using state-of-the-art linear and nonlinear laser spectroscopy in the femtosecond to millisecond time scales. These studies aim at clarifying various issues related to fundamental quantum mechanical processes and many-body phenomena in nanoscience. Results of such studies are relevant in solving problems related design of improved semiconductor optoelectronic devices.

Selected Publications:

On conversion of photoluminescence into absorption and the van Roosbroeck-Shockley relation, Bhattacharya, R., Pal, B., and Bansal, B., 2012, Applied Physics Letters, 100, 222103

Self-assembly and nonlinear optical property of a synthetic dipeptide, Maity, S.K., Kumar, R., Ambast, D.K.S., Pal, B., and Haldar, D., 2012, Journal of Materials Chemistry, 22, 22198

Spin relaxation in charge-tunable InP quantum dots, Pal, B. and Masumoto, Y., 2009, Physical Review B, 80, 125334

Spectral diffusion of type-II excitons in wurtzite InP/InAs/InP core-multishell nanowires, Pal, B., Goto, K., Ikezawa, M., Masumoto, Y., Mohan, P., Motohisa, J., and Fukui, T., 2009, Journal of Luminescence, 129, 1941

Type-II behavior in wurtzite InP/InAs/InP core-multishell nanowires, Pal, B., Goto, K., Ikezawa, M., Masumoto, Y., Mohan, P., Motohisa, J., and Fukui, T., 2008, Applied Physics Letters, 93, 073105

PhD Students:

Richarj Mondal, Deepak Kumar Sinha Ambast, Rupak Bhattacharya

Bipul Pal completed M. Sc. in Physics (university topper) in 1998 from University of Kalyani, WB, and Ph. D. in Physics (best thesis awardee) in 2004 from the Tata Institute of Fundamental Research, Mumbai. Following this, he was involved in postdoctoral research as an INOUE Fellow (1 year) and a JSPS Fellow (2 years) at University of Tsukuba, Japan. Subsequently, he returned to India to join as an assistant professor in the Indian Institute of Science Education and Research, Kolkata, in 2007. He is an Associate of the Indian Academy of Sciences and an INSA Young Scientist awardee.

Prasanta K. Panigrahi
Professor
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Quantum Computation, Field Theory

Although Quantum Mechanics is a well studied subject, Quantum computation has currently attracted significant attention, because of its possible practical applicability as also due to the counter-intuitive aspects of the quantum world. Prasanta explores various aspects of quantum communication like teleportation, dense-coding and secure direct communication in different quantum channels. Non-destructive discrimination of quantum states and quantum error correction are other areas of his interest.

In many-body physics, his interests lie in cold atoms, soliton dynamics in Bose-Einstien condensates and optical fibers. The electromagnetic response of graphene and topological insulators are the field theoretical systems under investigation by his research group. The fact that, these systems are well described by relativistic field theories makes them interesting to realize exotic relativistic phenomena, as well as subtle field theoretical effects like anomalies and their physical manifestations. Light matter interaction and Bio-photonics are also areas of great interest to him.

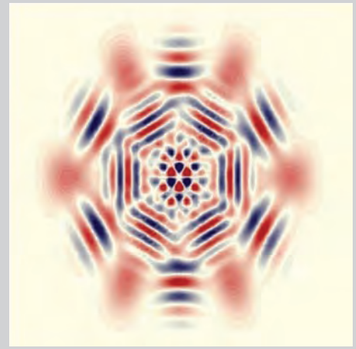

Image from "Sub-Planck-scale structures in the Pöschl-Teller potential and their sensitivity to perturbations"

Selected Publications:

Quantum violation of entropic non-contextual inequality in four dimensions, Pan, Alok K., Sumanth, M., and Panigrahi, Prasanta K., 2013, Phys. Rev. A, 87, 014104

Modulational instability of co-propagating light beams induced by cubic–quintic nonlinearity in nonlinear negative-index material, Gupta, Rama, Raju, Thokala Soloman, Kumar, Choragudi Nagaraja, Panigrahi, Prasanta K., 2012, JOSA B., 29, 3360

Distinguishing cancer and normal breast tissue auto-fluorescence using continuous wavelet transform, Gharekhan, Anita H., Arora, Siddharth, Pradhan, Asima, Panigrahi, Prasanta K., 2010, IEEE Journal of Selected Topics in Quantum Electronics, 16, 893

Perfect teleportation, quantum-state sharing, and superdense coding through a genuinely entangled five-qubit state, Muralidharan, Sreeraman, and Panigrahi, Prasanta K., 2008, Phys. Rev. A. 77, 032321

Loss of super-fluidity in the BoseEinstein condensate in an optical lattice with cubic and quintic nonlinearity, Das, Priyam, Vyas, Manan, and Panigrahi, Prasanta K., 2009 , J. Phys. B: At. Mol. Opt. Phys. 42, 245304

PhD Students:

Vivek M. Vyas, Kumar Abhinav, Priyam Das, S. Modak

After obtaining his PhD in Physics from the University of Rochester in 1988, Prasanta K. Panigrahi was a postdoctoral fellow at University of Illinois, Chicago and then at the University of Montreal. Prasanta moved back as a faculty in School of Physics, University of Hyderabad in 1993. He then joined Physical Research Laboratory, Ahmedabad in 2002. Since 2007 he has been with IISER Kolkata. He was an Elected Fellow, Gujarat academy of science, Gujarat and is also the referee for PRL, PRB, Journal of Physics, Pattern Recognition Letters, Physics Letter A, Pramana, and EPL etc. Recently, he has become a fellow of NASI, Allahabad.

Satyabrata Raj

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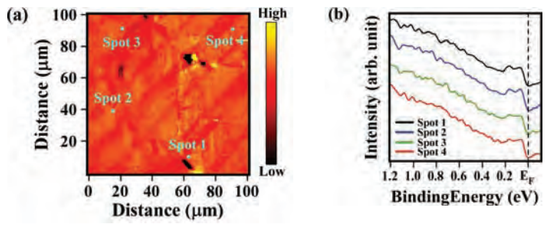
Experimental Condensed Matter

We investigate the electronic structure of strongly correlated systems by angle-resolved photoemission spectroscopy (ARPES). We study (i) Metal-Insulator Transition (MIT) in transition metal oxides (ii) Electronic structure of manganites showing CMR (iii) Superconductivity in Heavy Fermions (iv) Low-dimensional systems showing charge-density wave (CDW), (v) Electronic structure of the novel nano materials, super-ultra-thin films and/or one-dimensional chains etc.. We investigate to understand the luminescence, electronic and magnetic properties of various II-VI group nanoparticles. We synthesize such nanoparticles which can emit light when excited by a suitable source. The evolution of ferromagnetism in such dilute magnetic semiconductors is studied by measuring its magnetic properties with temperature.



(a) Spectromicroscopic image collected over 100 × 100 μm^2 area and (b) photoemission spectra of insulating $Na_{0.025}WO_3$ sample surface close to the Fermi level, E_F .

Selected Publications:

Electronic band structure and Fermi surface of low-dimensional $La_2Mo_2O_7$, Paul, S., Ghosh, A., and Raj, S., 2013, J. Phys. Chem. Solids, 74, 579

Structural phase transformation from wurtzite to zinc-blende in uncapped CdS nanoparticles, Ghosh, A., Paul, S., and Raj, S., 2013, Solid State Commun., 154, 25

Temperature dependent photoemission spectroscopy on lightly-doped sodium tungsten bronze, Paul, S., Ghosh, A., Chakraborty, A., Petaccia, L., Topwal, D., Sarma, D. D., Oishi, S., and Raj, S., 2012, Solid. State Commun., 152, 493

High-pressure investigations of $Na_{0.025}WO_3$: *x*-ray diffraction and Raman spectroscopy studies, Basu, A., Paul, S., Polentarutti, M., Bais, G., Oishi, S., Raj, S., and Mukherjee, G. D., 2011, J. Phys. : Condens. Matter, 23, 365401

Temperature dependent x-ray diffraction study of lightly doped Na_xWO_3, Paul, S., Mukherjee, G. D., Ghosh, A., Oishi, S., and Raj, S., 2011, Appl. Phys. Lett. 98, 121910

PhD Students:

Anirudha Ghosh, Sanhita Paul

Satyabrata Raj obtained his PhD in Physics from the Utkal University in 2001. He was a Research Associate at Indian Institute of Science and COE and JSPS Fellow at Tohoku University, Japan. He joined IISER-K in 2008.

Supratim Sengupta

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RNA, Origins and Complexity

Reaction-diffusion driven spatio-temporal oscillatory dynamics of proteins like *MinD* (blue) and *MinE* (red) ensure that the *E.coli* cell divides in the middle.

Our research deals with various aspects of the Origin and Evolution of Life as they pertain to regulatory RNA, Genetic Code and Biological Complexity at sub-cellular scales. We are specifically interested in the origin and evolution of the genetic code and whether regulatory RNA like riboswitches can be considered to have a primordial origin that can be traced back to the root of the tree of life. We also study how the oscillatory dynamics of some proteins at the sub-cellular level can lead to accurate regulation of mid-cell division in E.coli. We use computational modelling and bioinformatics tools to get insights into these topics.

We are also interested in understanding other types of complex systems like economic and social systems. We use evolutionary game theory techniques to understand how the costs and benefits associated with strategies employed by different individuals during their interactions with each other affect the frequencies of individuals in the population employing different strategies.

Selected Publications:

The Mechanisms of Codon Reassignments in Mitochondrial Genetic Codes, Sengupta, S., Yang, X., and Higgs, P.G., 2007, Journal of Molecular Evolution, 64, 662

Riboswitch Detection using Profile Hidden Markov Models, Singh, P., Bandyopadhyay, P., Bhattacharya, S., Krishnamachari, A., and Sengupta, S., 2009, BMC Bioinformatics, 10, 325

Classification of HIV-1 sequences using profile Hidden Markov Models, Dwivedi, S.K., and Sengupta, S., 2012, PLoS One, 7(5), e36566

Stuttering Min oscillations within E. coli bacteria: A stochastic polymerization model, Sengupta, S., Derr, J., Sain, A., and Rutenberg, A.D., 2012, Physical Biology, 9 , 056003

Phylogenetic analysis and comparative genomics of Purine riboswitch distribution in prokaryotes, Singh, P., and Sengupta, S., 2012, Evolutionary Bioinformatics, 8, 589

PhD Students:

Payal Singh, Ashutosh Vishwabandhu, Neha Aggarwal

Supratim Sengupta obtained his PhD in Physics from the Institute of Physics, Bhubaneswar in 2000. Subsequently he was a postdoctoral fellow at the University of Alberta, McMaster University and Dalhousie University. Supratim moved back to India in 2007 and joined the faculty of the School of Computational & Integrative Sciences, Jawaharlal Nehru University, New Delhi. After spending nearly 5 years in JNU, he joined IISER, Kolkata in December, 2011.

Ritesh K Singh
Assistant Professor
ritesh.singh@iiserkol.ac.in

High Energy Physics phenomenology and Quantum Field Theory

The world of sub-atomic entities are understood in terms of some fundamental particles and their interactions. These are described by quantum field theory (QFT) which is designed for such a purpose. This allows one to study the scattering experiments and production of new particles at various colliders. Ritesh studies the use of particle's spin and its polarization to probe the interactions among fundamental particles. To this end, he fabricates (proposes) various correlators that can be measured at the colliders and provide a clear probe to understand the interactions quantitatively. Further, he also appreciates that QFT is designed to cast sub-atomic entities as free particles and the forces are understood as instantaneous exchange of force carrying particles. This picture is unable to encompass gravitational force and thus a realm beyond the standard QFT is acknowledged. To this end also works on automatizing standard perturbative QFT calculations and exploring the ways to go beyond.

Selected Publications:

New physics contributions to the forward-backward asymmetry at the Tevatron, Biswal, S. S., Mitra, S., Santos, R., Sharma, P., Singh, Ritesh K., Won, M., 2012, Physical Review D, 86, 014016

On measurement of top polarization as a probe of $t\bar{t}$ production mechanisms at the LHC, Godbole,, R. M., Rao, K., Rindani, S. D., Singh, Ritesh K., 2010, Journal of High Energy Physics, 1011, 144

The Forward-backward asymmetry of top quark production at the Tevatron in warped extra dimensional models, Djouadi, A., Moreau, G., Richard, F., Singh, Ritesh K., 2010, Physical Review D, 82, 071702

A Model independent spin analysis of fundamental particles using azimuthal asymmetries, Boudjema, F., Singh, Ritesh K., 2009, Journal of High Energy Physics, 0907, 028

Kaluza-Klein excitations of gauge bosons at the LHC, Djouadi, A., Moreau, G., Singh, Ritesh K., 2008, Nuclear Physics B, 797, 1

PhD Students:

Lisa Edelhauser, Priyashri Kar

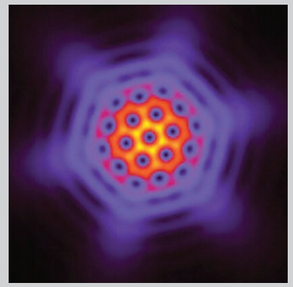
Ritesh Singh obtained his PhD in Physics from the Indian Institute of Science in 2006. Subsequently he was a postdoctoral fellow at LPT Orsay & LAPTH, Annecy in France and Wuerzburg University in Germany before joining IISER-Kolkata. He is young associate of Indian Academy of Sciences for 2011-2014.

Subhasis Sinha
Associate Professor
subhasis@iiserkol.ac.in

Theory of ultracold quantum gases and quantum dissipative dynamics

Research interests:

- Hydrodynamic and phase coherent collective properties of trapped Bose condensates: (e.g. rotating condensate, vortices and solitons in BEC, collective excitations of condensate with long range interaction, Josephson dynamics)
- Quantum Phase Transition of ultracold Bosons and Fermions in an optical lattice and correlated phases of cold atoms (e.g. Supersolid phase, density waves, paired supersolid etc.).
- BCS-BEC crossover
- Dissipative dynamics of quantum systems (Quantum Brownian motion, effect of dissipation on quantum phase transitions, quantum quench)



This graphics shows hexagonal lattice structure of a trapped condensate coupled to a synthetic gauge field.

Selected Publications:

Phases and collective modes of a hardcore Bose-Fermi mixture in an optical lattice,
Sinha, S. and Sengupta, K., 2009, Phys. Rev. B, 79, 115124

Nonperturbative approach to quantum Brownian motion, Sinha, S., and Sreeram, P. A., 2009, Phys. Rev. E, 79, 051111

Dissipative quantum systems and the heat capacity , Dattagupta, S., Kumar, J., Sinha, S., and Sreeram, P. A., 2010, Phys. Rev. E, 81, 031136

Superfluid-insulator transition of ultracold bosons in an optical lattice in the presence of a synthetic magnetic field, Sinha, S., and Sengupta, K., 2011, Europhys. Lett., 93, 30005

Trapped Two-Dimensional Condensates with Synthetic Spin-Orbit Coupling, Sinha, S., Nath, R., and Santos, L., 2011, Phys. Rev. Lett., 107, 270401

PhD Students:

Arpita Sen, N. Linga Murthy

Subhasis Sinha obtained his PhD in Physics from the Institute of Mathematical Sciences in 2001. He was a postdoctoral fellow at Ecole Normale Superieure (Paris), Max Planck Institute for complex systems (Dresden), Stuttgart University and visiting scientist at Laboratoire de Physique Theorique et Modeles Statistiques (Orsay). He was 'Faculty fellow' at S. N. Bose National Centre for Basic Sciences (Kolkata) from 2006 to 2008. Subhasis joined IISER-Kolkata in 2008.

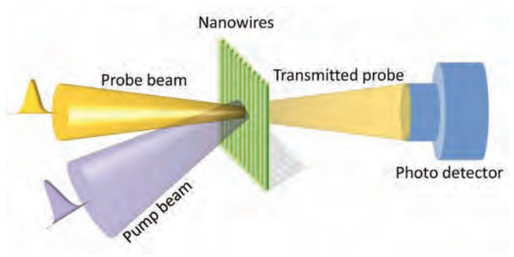
Prashanth Upadhya

Assistant Professor
pupadhya@iiserkol.ac.in

Exploring the light-matter interaction in minuscule space and time scales

The objective of our research is to develop and apply ultrafast optical tools that can temporally (at the fundamental timescale) as well as spatially resolve light-matter interaction over a broad wavelength range from the visible to the far infrared (Terahertz). We employ tunable ultrafast lasers to develop novel ultrafast spectroscopy systems that can probe both static and non-equilibrium dynamics in variety of systems.

One of our research interests is in the area of terahertz science since terahertz (10^{12} Hz) radiation has immense scientific and technological importance because it embraces the fundamental interface between electronics and photonics. Our efforts are aimed at developing ultrafast terahertz sources and detectors, and implement them for variety of applications including spectroscopy, imaging and sensing.



Further, by employing variants of ultrafast techniques (for example, ultrafast microscopy) we study ultrafast carrier dynamics in nanostructured materials and explore new approaches to realize optimized functionalities of nanodevices for their application in nanophotonics and energy harvesting.

Selected Publications:

Understanding ultrafast carrier dynamics in single quasi-one-dimensional Si nanowires, Seo M. A., Dayeh S. A., Upadhya P. C., Martinez J.A., Swartzentruber B. S., Picraux S. T., Taylor A. J., and Prasankumar R. P., 2012, Applied Physics Letters, 100, 071104

Influence of surface states on the transient photoconductivity in Si nanowires, Kar A., Upadhya P. C., Dayeh S., Picraux S. T., Taylor A. J., and Prasankumar R. P., 2011, IEEE Journal of Selected Topics in Quantum Electronics, 17, 889 (invited paper)

Dual-band ultrafast optical switching device with negative-index metamaterial, Dani K. M., Ku Z., Upadhya P. C., Prasankumar R. P., Brueck S. R. J., and Taylor A. J., 2011, Optics Express, 19, 3973

The influence of defect states on non-equilibrium carrier dynamics in GaN nanowires, Upadhya P. C., Li Q., Wang G. T., Fischer A. J., Taylor A. J., and Prasankumar R. P., 2010, Semiconductor Science and Technology, 25, 024017 (invited paper in special issue on nanowires)

Sub-picosecond optical switching with a negative index metamaterial, Dani K. M., Ku Z., Upadhya P. C., Prasankumar R. P., Brueck S. R. J., and Taylor A. J., 2009, Nano Letters, 9, 3565

PhD Students:

Sudipta Sengupta, Mandira Pal

Dr Prashanth Upadhya obtained his PhD in Physics from Cavendish Laboratory, University of Cambridge, UK in 2004. Following this he was post doctoral research associate at University of Leeds, UK and research fellow at Center for Integrated Nanotechnologies, Los Alamos National Laboratory, USA. He joined IISER Kolkata in 2011 as a member of faculty in the Department of Physical Sciences.

ACHIEVEMENTS

Although the Department of Physical Sciences at IISER Kolkata is relatively young, it is well on its way towards being a major hub for the study of Physics and allied subjects in India. Our faculty have published in renowned interdisciplinary journals as well as in top journals within their field. They have produced students who are now pursuing higher studies at renowned Universities around the world. Their contributions to science have been recognized both within and outside the country with prestigious awards, honours and fellowships. Departmental faculty also play leaderships roles nationally and internationally and lead major projects of importance to their field. Here is a highlight of these achievements.

Student Performance and Placement

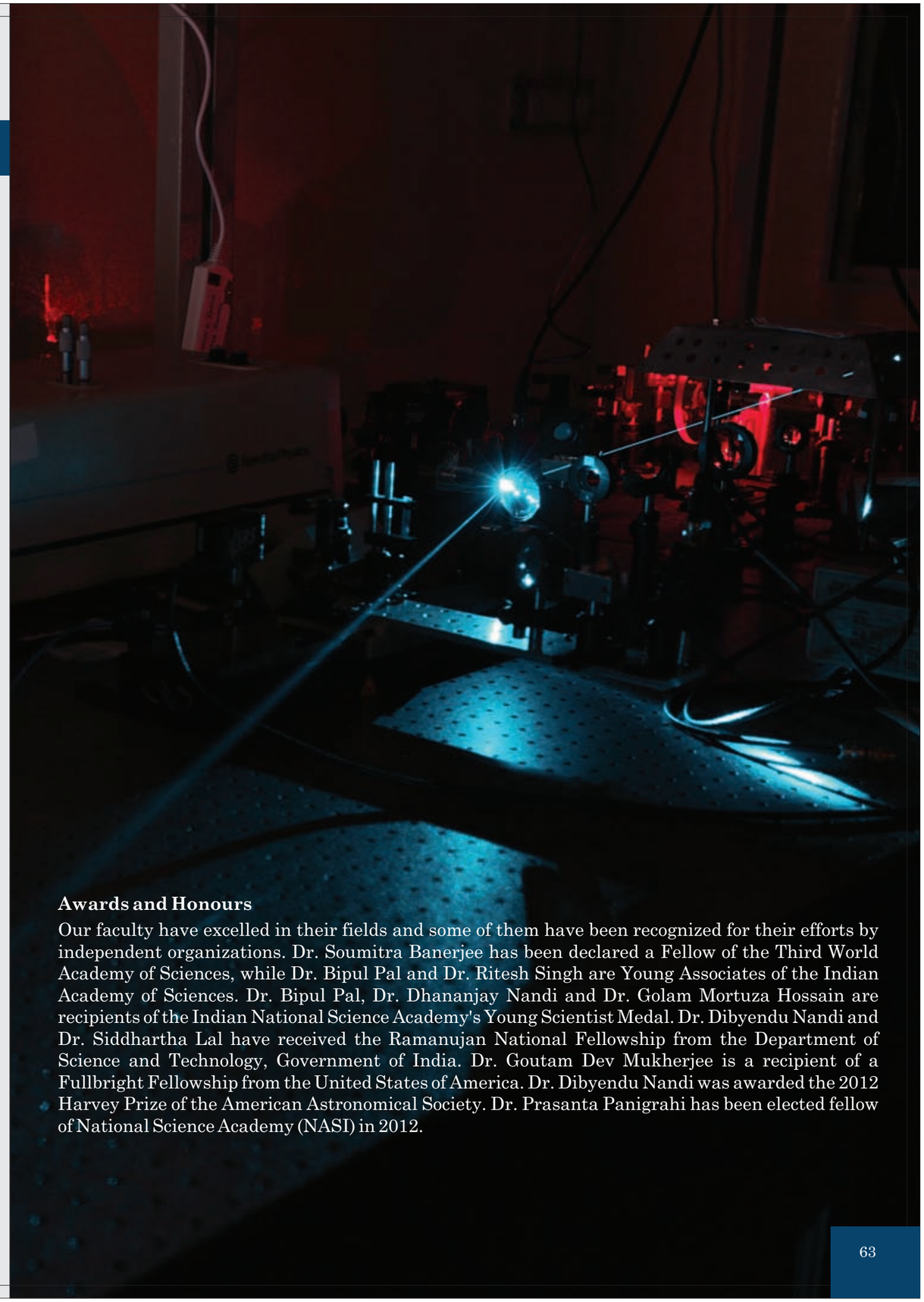
We leave no stones unturned in our effort to impart the best education to our students in a setting that is structured around a formal course-work but which provides ample opportunities of informal interaction to ignite a young, ambitious mind. The fruits of our labour are to be found in the success stories of our past students who have competed with the best of the world to secure positions in top Universities – where they are expected to be the future of Science. This we deem to be our biggest achievement. We produced the only Rhodes Scholar from India in the field of Sciences in 2011 and also a Clarendon Scholar – both now at University of Oxford. Our students are placed in Cornell University, Ecole Normale Superiere, University of Goettingen, Indian Institute of Science, Jawaharlal Nehru Centre for Advanced Scientific Research, and Rutgers University amongst others. We hold our students very dear and are confident that they will make a positive impact wherever they are.

Research Output and Publications

Our primary love is for doing science. While that pursuit should not always be reduced to statistics such as the number of publications and the impact factor of the journals we publish in, that exercise is sometimes useful for general comparisons. Physics Department faculty have in their portfolio the best international journals such as Nature, Nature Physics, Nature Genetics, Science and Physical Review Letters – in addition to the best specialized journals of their field. Their research works have garnered international attention and has been the focus of multiple press releases and feature articles in top media outlets in India and abroad.

Major Projects and Leadership Roles

Faculty at the Physics Department have gone beyond the domain of their individual research to play leadership roles within their community and are involved in projects of major significance. Currently operational cumulative sponsored project grants amount to Rs. 7,80, 58,200 (i.e. INR 7.80582 Crores). Dr. Goutam Dev Mukherjee is the Principal Investigator of a major High Pressure facility funded by the Ministry of Earth Sciences that seeks to explore extreme conditions that are to be found in the Earth's interior. Dr. Dibyendu Nandi is the Principal Investigator and Coordinator of the Ministry of Human Resource Development's Center of Excellence in Space Sciences that is envisaged to study the Sun, explore space weather and help in the hunt for gravitational waves. Dr. Dibyendu Nandi is also a science team Co-Investigator for India's first solar space mission Aditya and is Vice-Chairman of the Panel on Space Weather for the international Committee on Space Research (COSPAR) and Chairman of the International Astronomical Union Working Group on Solar and Stellar Environments. Dr. Rajesh Nayak is playing a significant role in the Laser Interferometer Gravitational Wave Observatory (LIGO)-India project which is envisaged to deploy instruments for detecting gravitational waves.



Awards and Honours

Our faculty have excelled in their fields and some of them have been recognized for their efforts by independent organizations. Dr. Soumitra Banerjee has been declared a Fellow of the Third World Academy of Sciences, while Dr. Bipul Pal and Dr. Ritesh Singh are Young Associates of the Indian Academy of Sciences. Dr. Bipul Pal, Dr. Dhananjay Nandi and Dr. Golam Mortuza Hossain are recipients of the Indian National Science Academy's Young Scientist Medal. Dr. Dibyendu Nandi and Dr. Siddhartha Lal have received the Ramanujan National Fellowship from the Department of Science and Technology, Government of India. Dr. Goutam Dev Mukherjee is a recipient of a Fullbright Fellowship from the United States of America. Dr. Dibyendu Nandi was awarded the 2012 Harvey Prize of the American Astronomical Society. Dr. Prasanta Panigrahi has been elected fellow of National Science Academy (NASI) in 2012.

ALUMNI

ALUMNI INFORMATION OF THE DEPARTMENT OF PHYSICAL SCIENCES OF IISER KOLKATA AS ON 21ST FEBRUARY 2013

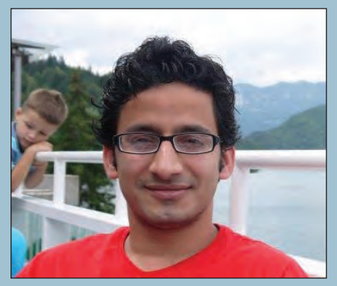
Batch BS-MS 2011(1st Year)

Name of the Students	Position	Placed at	Honorary funding
Challenger Mishra	DPhil, Rudolf Peierls Centre for Theoretical Physics	University of Oxford	Rhodes Scholar 2011
Sambit Bikas Pal	PhD in Quantum Matter Group, Centre for Quantum Technologies	National University of Singapore	CQT Scholarship
Abhishek Dasgupta	DPhil, Department of Computer Science	Oxford University	Clarendon Scholar
Sayan Choudhury	PhD in Theoretical Condensed Matter Physics	Cornell University	
Aabhaas Vineet Mallik	PhD in Center for Condensed Matter Theory, Department of Physics	Indian Institute of Science	CSIR Shyama Prasad Mukherjee Fellow (2011)
Ebad Kamil	PhD in Theoretical Condensed matter physics at Institute for Theoretical Physics	University of Goettingen Germany	DFG FOR 1346 (German Science Foundation) grant
Asit Singh	lecturer in physics	hometown	
Anshul Saini	PhD in Physics	SUNY Buffalo	
Bradraj Pandey	PhD in Theoretical Science Unit JNCASR	Jawaharlal Nehru Centre for Advanced Scientific Research	CSIR-UGC-JRF
Arijit Haldar	PhD physics India	IISc Physics Department	Fellowship: CSIR SPM Fellow
Ipsita Satpathy	PhD	Univ of Goettingen	

Batch BS-MS 2012(2nd Year)

Name of the Students	Position	Placed at	Honorary funding
Ankur Shringi	Project Assistant, Bangalore	Divecha Center for Climate Change,IISc,	
Amit Nag	PhD candidate Dept of Physics, Univ of Maryland, College Park	5029, Berwyn Road, College Park, MD 20740,USA	
Amit Anand	Pursuing MBA from XLRI(HR)	Human Resource Management, XLRI, Jamshedpur	
Irfan Raza			
Piyush Pushkar	Preparing for civil services	Near DAV School, Mourya Vihar Colony, Transport Nagar, Kumhrar, Patna 800026	
Aniket Patra	PhD Physics,	Rutgers University 6898 RPO Way College Avenue, New Brunswick, New Jersey - 08901	
Debashis Sanyal	PhD Student	Argelander Institute for Astronomy, University of Bonn, Germany	
Sibasish Banerjee	PhD Student	University of Montpellier and Ecole Normale Superieure, France	
Anish Bhardwaj	PhD	Florida State Universiy	
Debanjan Basu	PhD, GAUSS	University of Gottingen	
Dibya Chakravorty	Research Assistant, IISER-Kolkata	IISER-Kolkata	
Satish Kumar	PhD (Physics)	University of Texas Arlington, USA	
Harsh Purwar	Doctoral Student	CORIA, University du Rouen, France	

Alumni Space: Messages from our Students



Name: Challenger Mishra, Rhodes Scholar
Year of Graduation (MS Program): 2011
Current Institution: University of Oxford, UK
Degree Enrolled in: D.Phil. in Theoretical Physics

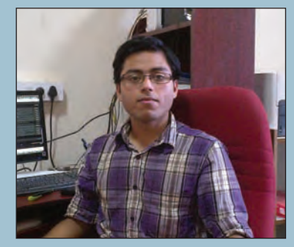
The Physics department at IISER Kolkata boasts of a faculty each member of which is an adept researcher and a brilliant teacher. One of the most exciting features of studying Physics, much like studying any other subject at IISER Kolkata, was the pool of interdisciplinary subjects one could procure knowledge in. This really opened up to us the fact that science is meant to be interdisciplinary. The fact that several faculty members were leaders of their fields truly inspired me. Studying at the IISERs provides an edge to anyone wishing to pursue a career in basic science. The Physics department at IISER Kolkata is no anomaly. During my time, I engaged in research projects not only at my department but also at other institutes around the world. These were crucial in securing admission for further studies at the Institute of my choice. The focal point of the curriculum is involvement in research projects and this inevitably lays the foundations of an exciting career of research in basic science.

Name: Ebad Kamil
Year of Grad (MS Program): 2011
Current Institution: Institute für TheoretischePhysik, Universität Göttingen, Germany
Degree Enrolled in: PhD

5 years at IISER Kolkata indeed turned out to be the most fruitful years of my life. The entire curriculum at IISER Kolkata including well planned course work, intensive research projects, presentations and allowing students to work as teaching assistants for faculty, worked out to be the most suitable recipe for starting a balanced research life. Due to very moderate student-teacher ratio at the Department of Physical Sciences, healthy and friendly research and teaching discussions were abundant. I feel privileged to have been part of the Department of Physical Sciences at IISER Kolkata.

Name: Aabhaas Vineet Mallik
Year of Graduation (MS Program): 2011
Current Institution: Indian Institute of Science, Bangalore
Degree Enrolled in: PhD

It has been a couple of years since I graduated from IISER Kolkata. So, it may not be possible for me to remember all the subtle things about the Department of Physics, which helped me grow as a student and as a person. Nevertheless, looking back at the coarse-grained picture of the five years that I spent at IISER Kolkata, I have no doubt that the training, company and exposure that I got at IISER was completely transforming in nature, both at academic as well as personal level. Though the learning process is still going on, and in all likelihood, will go on for quite some time, I truly feel that the years spent at IISER Kolkata were crucial in making me capable of taking this journey into the field of research in Physics and Science in general.



Name: Dibya Chakravorty
Year of graduation (MS): 2012
Current Institution: TU Munich, Germany
Degree Enrolled in: PhD

Studying at Department of Physical Sciences, IISER Kolkata has been fun and rewarding. With a comprehensive course list (with a vast pool of specialized topics to choose from), modern lab equipment, ridiculously high teacher to student ratio and a culture of promoting core and interdisciplinary research, it's hard to find a better place to get a Physics degree from. I got a generous stipend to support my studies and living, friendly professors and peers to interact with, an informal atmosphere and all the help and guidance that I needed to further my career in research. While the level of course work was challenging, everything else was taken care of. The new BS-MS format with compulsory MS Thesis is internationally acceptable, making sure I never had application jitters after graduating. The large body of faculty representing almost every specialization in Physics meant that I had the freedom to pursue research in any field that caught my fancy. Compulsory seminar courses and a vast array of computational courses that complement coursework made sure that I graduated with a know-how and skill set at par with global standards. Internship opportunities in the best research labs and groups in India and abroad swarmed in plenty during every summer and winter break. Inquivesta, the signature science fest of IISER Kolkata added fuel to our crazy ideas and out of the box thoughts every year. I thoroughly enjoyed my time here and am grateful for the edge it gave me over the traditional university system.

Name: Arijit Haldar
Year of Graduation (MS Program): 2011
Current Institution: Indian Institute of Science, Bangalore
Degree Enrolled in: PhD

I am delighted to hear about the idea of former students expressing their views in the Departmental Brochure. The time spent by me at IISER Kolkata was really great, although we had to change our hostels a few times. Finally we did get our permanent hostels at Mohanpur, which I might say was arranged very quickly considering the fact that Institute was just two years old. After the end of the 4th semester, I chose Physics as major. The curriculum was very thoughtfully organised, and being the first batch wewere able to persuade our professors to teach few courses and topics, that are not usually taught at the undergraduate level, like Quantum Field Theory, General Theory of Relativity. Even the laboratory experiments covered lot of the aspects of classical and quantum physics. The best part I enjoyed about the laboratory curriculum was that we had do a final project at the end of each semester, and we were allowed to be as imaginative as possible, to make any kind of instruments or experiments that would allow us to study some interesting physics. As far as preparing for the exams like NET, GATE, JEST, GRE etc., I did not have to study anything extra. In fact I did not even bother preparing for these exams until the very end. The courses that we credited, the extensive assignments and lab quizzes were enough to prepare us for these exams. In the final year of our Integrated MS program, we had to do a project that contributed to our thesis. For this I was able to work on some recent areas of classical optics. The experience gained in doing my MS project was extremely valuable, and it gave me an idea how real life research is actually done.

Name: Barun Majumder
Year of Graduation (PhD): 2013
Current Institution: IIT Gandhinagar
Current Position: Assistant Research Professor

The tranquil and natural environment of IISER Kolkata is very much suitable and ideal for graduate studies. The diversity of the background in the Physics community contributed greatly in learning many recent research aspects of Physics. IISER Kolkata with its emphasis on cutting edge and empirical research has immensely facilitated in acquiring skills essential to accomplishing my career goals. My learning from IIISER Kolkata is indispensable. More importantly, IISER Kolkata gave me the utmost freedom for independent research and thinking with which I am enjoying my research every moment of my life.

EDUCATION, OUTREACH AND MEDIA

At IISER Kolkata, in addition to reaching out to prospective students in various schools, colleges, and universities, we try to contribute our bit to spread scientific awareness in general to the layman, revealing science as a simple, innovative and fun enterprise. The Department of Physical Sciences too does its bit in reaching out to the external world and spread the joy of physics to all and sundry. In the process, our efforts towards spreading awareness are channelized in three main directions:

Public Lectures in Association with Science City:

IISER Kolkata, in association with Science City, hosts internationally acclaimed scientists in public lectures. Admission to these special events is free for school and college students. The aim is to provide a source of inspiration for students and encouraging young minds of the community to emulate interest so as to consider pure sciences as a career option. The packed auditoriums and halls testify to the strong spirit of enthusiasm as the modern fathers of the sciences instill and enhance a fascination for science and aptitude for excellence.

Some of the distinguished physicists we hosted in the past few years include:

- George Fitzgerald Smoot (Nobel Laureate in Physics, 2006)
- Loren Acton (Astrophysicist and Astronaut, NASA)
- Roger Penrose (Recipient of the Wolf Prize, known for his work on Black holes with Stephen Hawking and his books "Emperor's new mind"and "Road to Reality")
- Sir Anthony Leggett (Nobel Laureate in Physics, 2003)

International Exposure

IISER Kolkata believes in exposing its students to top class facilities. In this regard DPS has successfully collaborated with a number of reputed institutes. Our students have won fellowships and completed projects in places like Rochester Institute of Technology, Caltech, University of Goettingen and University of Hamburg etc. Similarly physics students from top institutes across the globe have found our research environment conducive. Amongst the recent visitors to our institute, we have had students and scientists from Gottingen University, Montana State University, Lund University, University of Toulouse, Changshu Institute of Technology, etc. Also, students are regularly encouraged to visit renowned labs and institutes, both national and international, for summer programmes extending between eight to twelve weeks. DPS students have visited labs in universities and research institutes such as the Max Planck Institute for Quantum Optics, University of Rochester, Rice University, Goethe Universitaet, University of Heidelberg, University of Texas at Arlington, National University Singapore, Indian Institute of Science Bangalore, Tata Institute of Fundamental Research, National Center for Biological Sciences and National Center for Radio Astronomy.

Lectures by Department Faculty

DPS faculty also regularly visits local schools, colleges and Organizations for lectures in general topics in Physics as well as on their own fields of research. Faculty have delivered public lectures in various forums such as the Jawaharlal Nehru Planetarium (Bangalore), Alliance Francaise's Bonjour India Festival and student fests at IIT Kharagpur, NIT Durgapur, St. Xavier's College etc.

Interaction with Schools and College Departments

The Department has organized programs to reach out to local schools and colleges. Apart from lecturing at these institutions, we invite local schools and colleges to visit our Department in our campus. In these visits, there a handful of talks by Departmental faculty about exciting research areas of Physics in which we work, research laboratory visits and hands-on demonstration experiments in teaching laboratories. Very recently, the students of physics in St. Xavier's College, Kolkata visited DPS, IISER Kolkata. We encourage teachers from all schools and colleges to visit and interact with us to exchange new ideas and methodologies of classroom and laboratory instruction. This is in keeping with our philosophy of not just attaining excellence in teaching within our boundaries, but disseminating that knowledge base outside, as well as assimilating excellent and novel teaching methods from other institutes.

INQUIVESTA – The Science Fest

The students' body of IISER Kolkata organizes its annual science fest called INQUIVESTA in spring each year. The fest has been sponsored by various MNCs including Pfeiffer, Buchi, HOLMARC, etc. Inquivesta is the scientific alternative of tech-fests; participants hail from various colleges from all over India ranging well above a thousand every year.

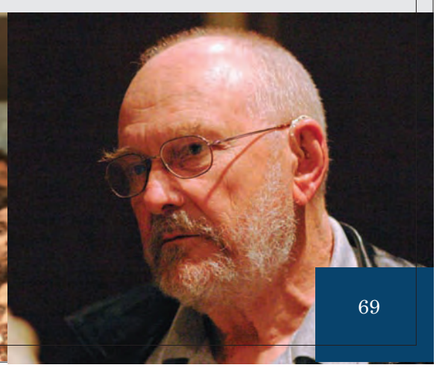
The first ever science fest of its kind in India, Inquivesta aims at celebrating the spirit of science among the students of India. Several students belonging to DPS, both undergrads with physics major, and graduate students participate actively in both organizing as well as participating in INQUIVESTA.

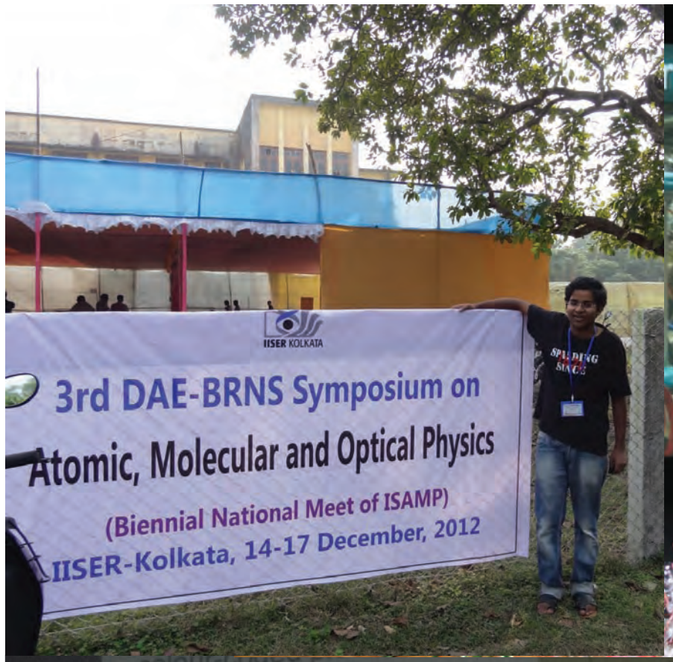
JAGRITI: Social Service Forum

Jagriti is IISER Kolkata's social outreach and help forum, with the workforce including both students and faculty. Since 2009, Jagriti has organized regular classes for the children of security guards, daily wage laborers and other miscellaneous workers who work in the IISER campus. It complements regular school studies with an innovative program of familiarization with science and the languages. Such classes have separate modules, taught by student volunteers, aimed at children studying in classes 5 to 12. Jagriti has recently encompassed a wider range of social activities by organizing regular free medical checkups and blood donation camps with the help of the Institute doctor. Additional donation drives such as distributing warm clothes during winter to people residing in the rural areas around the campus are made. DPS students and faculty members play key roles in Jagriti with a sincere and whole-hearted goal towards reaching out to the underprivileged in our society.

Print, Television Media and the General Public

Research work performed by faculty at the Physics Department have been featured in press and television media both within and outside the country. We appreciate that sharing the excitement of what we do with the general public through media is a necessary and important aspect of publicly funded science programmes. News of our research and interviews of our faculty have appeared in diverse forums such as Reuters, ABC, CBC, Sydney Morning Herald, Dawn, Times of India, Telegraph, Hindu, Deccan Herald, Hindustan Times, Indian Express, The Week, India Today, New York Times Dot Earth Blogs, Scientific American, Sky and Telescope, Discovery Magazine, CNN-IBN, Lok Sabha TV and All India Radio. Our faculty have also written invited articles for reputed magazines such as BBC Knowledge and Physics Today.





CONFERENCES AND VISITORS

1. **International Conference on Cold Atoms,**
   12-16 December, 2008,IISER Kolkata
   Organizers: P., Panigrahi, C. Mitra, P. Sreeram

2. **Workshop on LHC Physics at IISER Kolkata**
   19-24 December, 2008, IISER Kolkata
   Convener: Amitava Datta

3. **The Universe Under a Microscope: Physics at the Large Hadron I Collider**
   30th October, 2009, Science City Kolkata, Kolkata
   Organizers: Harishchandra Research Institute (Allahabad), IISER Kolkata, and Science City (Kolkata)

4. **International Space Climate Symposium 4**
   16-21 January, 2011, Goa, India
   http://www.iiserkol.ac.in/~spaceclimate4/
   LOC Chair and Institution: Dibyendu Nandi, IISER Kolkata

5. **Workshop on Field Theory : Recent trends and applications**
   22-25 August, 2011, IISER Kolkata
   http://www.iiserkol.ac.in/~ftrta2011/
   Organizer: Prasanta Panigrahi

6. **Current Topics in Condensed Matter**
   7-9 October, 2011, IISER Kolkata
   http://www.iiserkol.ac.in/~ctcm2011/CTCM2011.html
   Organizers (IISERK): S. Dattagupta, Siddhartha Lal, Arindam Kundagrami, Rumi De

7. **Indo-Israel Meeting on Condensed Matter**
   15-18 October, 2011, Cochin, Kerala
   http://www.iiserkol.ac.in/~iimcm5-2011/index.html
   Organizers (IISERK): S. Dattagupta

8. **ICTS International Nonequilibrium Winter School**
   27 December, 2011 – 11 January, 2012, IISER Kolkata
   http://www.icts.res.in/program/details/282/
   Organizers: Sushanta Dattagupta, Yuval Gefen, Amit Ghosal, Ganpathy Murthy, Sanjay Puri, Sriram Ramaswamy, Krishnendu Sengupta, Nayana Shah and Subhasish Sinha

9. **1st Inter-IISER Physics Meet**
   17-19 February, 2012, IISER Kolkata
   http://www.iiserkol.ac.in/~iipm/
   Organizers: Uday Kumar, Ritesh Singh and Bhavtosh Bansal

10. **3rd DAE-BRNS Symposium on Atomic, Molecular and Optical Physics 2012**
    14-17 December, 2012, IISER Kolkata
    http://www.iiserkol.ac.in/~amop2012/committee.html
    Organizing Committee: Dhananjay Nandi, Amlan Roy and Ashwani Kumar Tiwari

Eminent Visitors for DPS Seminars and Colloquia

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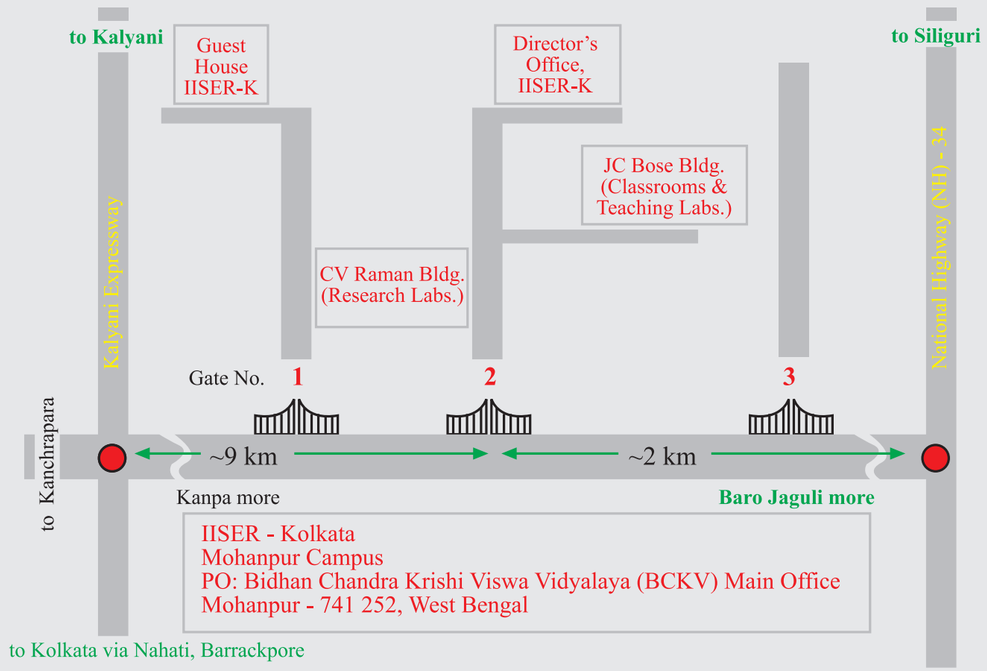
LOCATION

The modest beginning of IISER Kolkata was made from the IIT Kharagpur extension centre and NITTTR campus at Salt Lake, Kolkata in August, 2006. In July 2008, IISER Kolkata was moved to Mohanpur in the Nadia district of West Bengal. The nearest railway station, Kanchrapara, is located on the Sealdah-Kalyani-Krishnanagar main line, about 9 km due west from the campus. The National Highway 34 (NH34) passes through a nearby crossing, Barajaguli, and connects the campus to Kolkata, approximately 50 km away. Alternatively, Kolkata is connected to IISER Kolkata campus through the Kalyani Expressway via Kanchrapara and Barrackpore.

The transit campus, including classrooms, laboratories, and hostels, is a temporary arrangement within the picturesque campuses of Bidhan Chandra Krishi Viswavidyalaya (BCKV) and West Bengal University of Animal & Fishery Sciences (WBUAFS). The permanent campus, in which the construction activities are underway, is being built on a two-hundred acres of land in the nearby Haringhata Mouza that is just 15 minutes bicycle ride away from the transit campus. A lot of teaching and research activities, and facilities currently run from various temporary (pre-fabricated) and permanent buildings in the main campus. The new hostel block for students in the main campus is nearing its completion. The transit and main campuses are well-connected through dedicated bus and vehicle services by IISER Kolkata. The campus is planned to be a green campus, wherein students, faculty and staff can live in harmony with nature. Currently IISER Kolkata is functioning both from transit and permanent campuses.



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