



हैदराबाद विश्वविद्यालय UNIVERSITY OF HYDERABAD



School of Physics

Sum Over History





About the School

- Established in 1977.
- The School of Physics is a center of excellence for multi-disciplinary and interfacial research, teaching in diverse fields ranging from nano sciences and cold atoms to Astrophysics and cosmology, photonics, quantum field theory, spintronics, and particle physics to complex systems.
- **School of Physics engages with physics at all scales**
- Selected by the UGC as the Centre for Advanced Study (CAS) Level II.
- DST selected for level II funding under the FIST Scheme.
- One of the five founding centres for the Theoretical Physics Seminar Circuit (TPSC) by DST.
- The School has been acknowledged as a 'Centre of Excellence' by the Third World Academy of Sciences, Trieste, Italy.
- School with a healthy gender ratio among the faculty.
- In the past 7 years School has generated funding to the tune of ₹ 700 lakhs from various national and international funding agencies such as DST, SERB, CSIR, ADA, DRDO, UNESCO, ITER, NSF and many other sources.
- School of Physics under its umbrella has different academic centers such as CASEST, ACRHEM, UCESS



CASEST
CENTRE FOR ADVANCED STUDIES IN
ELECTRONICS SCIENCE & TECHNOLOGY

CASEST

- Centre for advanced Studies in Electronics Science and Technology (CASEST) was established in 2014
- It offers M.Tech (Integrated Circuits Technology) and Ph.D (Electronics Science) programme
- Collaborates actively with industry and academia



UGC NRC

- The UGC Networking Resource Centre with the aim to network with other institutions, especially undergraduate and postgraduate colleges and universities in the region, and thereby contribute to the improvement in Physics education and research.
- UGC-NRC is successfully conducting workshops, summer & winter schools, and Training visits



Academic Programme

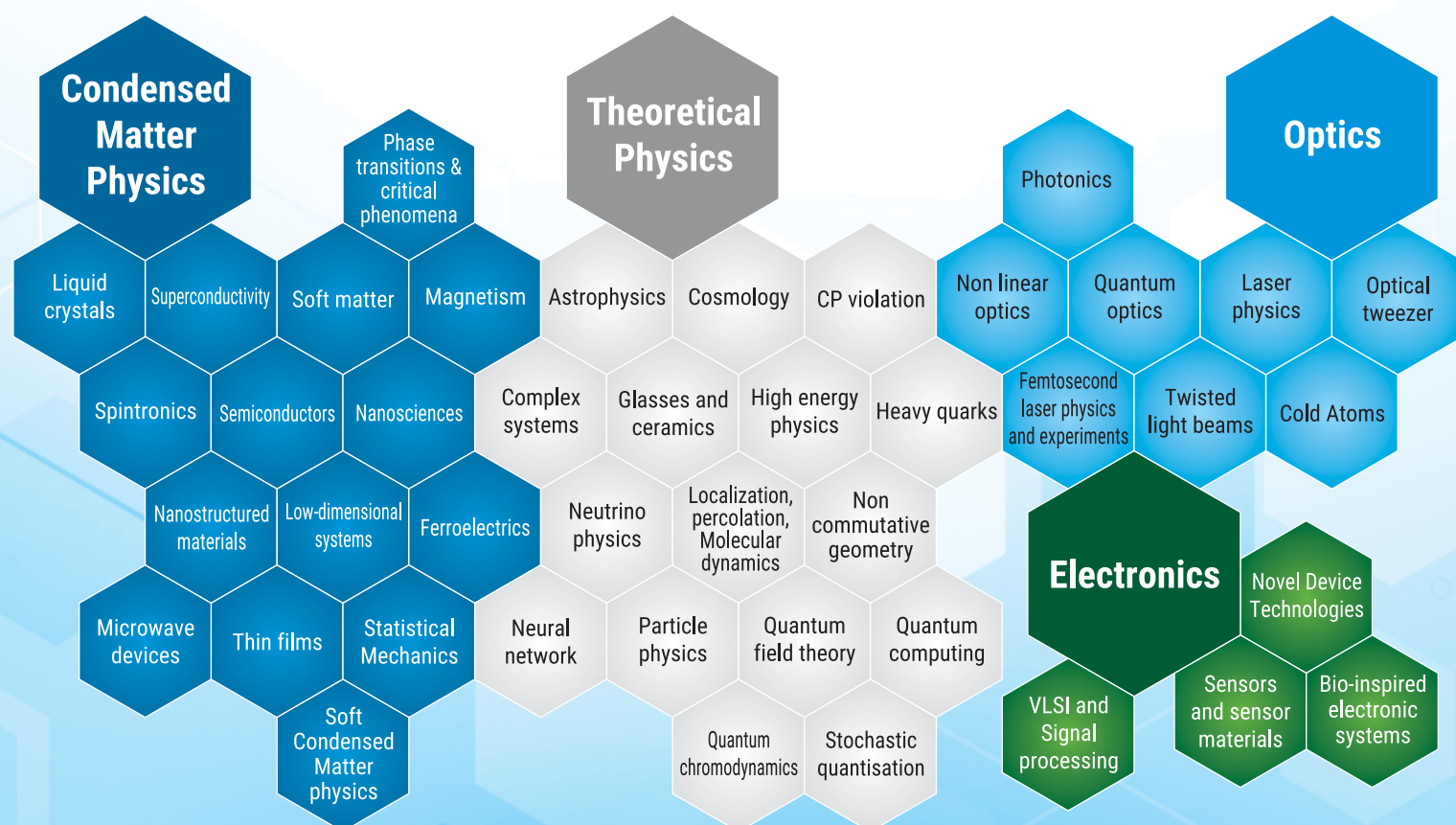
- School offers Integrated M.Sc (5 year), M.Sc., M.Tech. (IC Technology) and Ph.D (Physics) and Ph.D (Electronic Sciences) programmes.
- Over 2000 students have graduated with Masters degree in Physics
- Student-teacher ratio is highly favourable for individual attention.
- Emphasis is on problem solving, Skill development (experimental and computational) and hands on experience with state of the art teaching laboratories.
- Large Number of optional courses are offered.
- Active research programme to train Ph.D. scholars. 250 students were awarded Ph.D with many receiving national and international recognitions.
- Our Alumni are among the faculty of IITs, IISERs, IAP, IMSc, TIFR, central and State Universities, Scientists at National Laboratories such as NPL, DAE, DRDO, IICT and many more top academic institutions in U.S, Europe and Asia.
- Many of the Alumni are also serving at various capacities in Industry .

Optional Courses Offered

- General Theory of Relativity,
- Many Body Theory,
- Phase transitions and Critical Phenomena,
- Dynamical systems and Chaos,
- Liquid Crystals, Quantum Optics,
- Lie Groups & Lie Algebra,
- Ultrafast Phenomena,
- Low-temperature Techniques,
- Nanoscience and Nanotechnology,
- Physics of Materials,
- Ferroelectrics & Electroceramics,
- Cavity Quantum Electrodynamics,
- MEMS Theory & Laboratory,
- Nanostructuring,
- Optical Cooling,
- Nonlinear Optics.

Areas of Research at a Glance

The School of Physics is a centre of excellence for multi-disciplinary and interfacial research and teaching in diverse fields. School of Physics is also a UGC Networking Resource Centre.



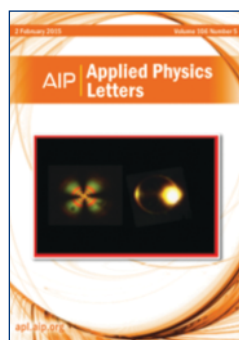
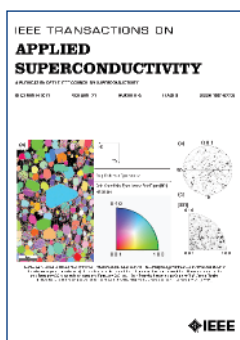
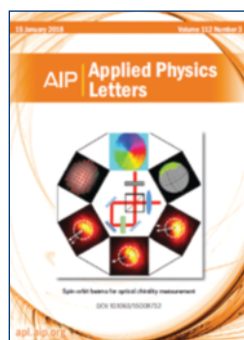
Research Publications

- Faculty have more than 3500 publications in peer reviewed journals since its inception
- Average h-index of the school 82
- Total number of patents 9

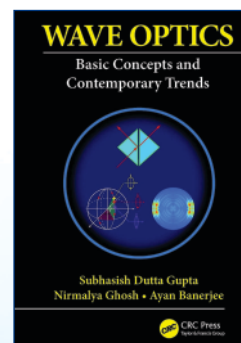
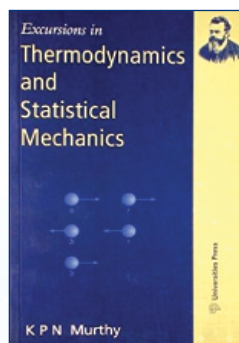
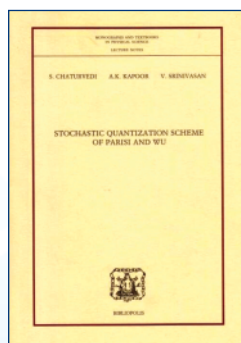
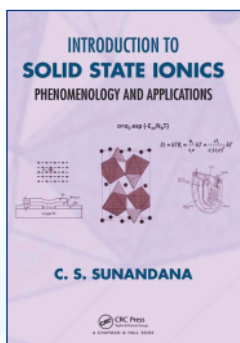
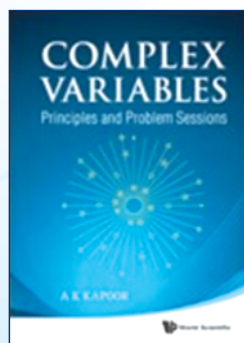
Our Faculty in Editorial boards

- American Journal of Modern Physics
- Bulletin of Materials Science
- European Physical Journal D (EPJ D)
- Journal of gender science and Technology
- Journal of Physics Education
- Modern Physics Letters B
- Optical Engineering, SPIE, USA
- Pramana – J. Phys.
- Radiation Effects and Defects in Solids
- Physics Research International
- Advances in Condensed Matter Physics

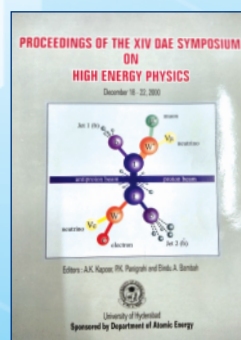
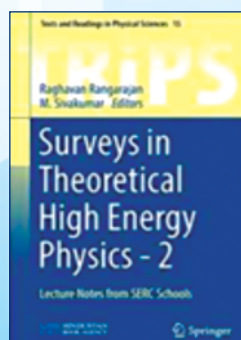
Cover Pages of Journals



Books Published by Faculty



Books Edited by Faculty

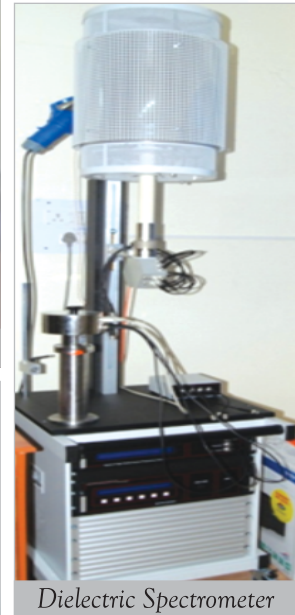


Experimental Facilities

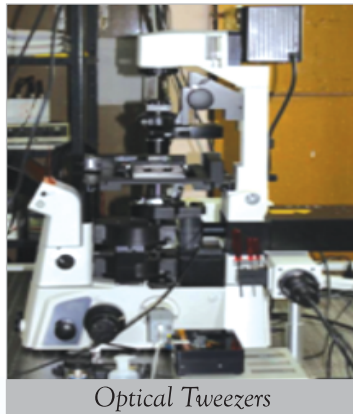
- Rheometer
- Nano Cluster Deposition
- E beam evaporation system
- RF sputtering system
- UV-VIS-NIR Spectrophotometer
- Cryogenic Magnetic Probe Station
- Wafer Prober @ microwave frequencies
- 3D-Printer
- SQUID VSM (CFN)
- PPMS (CFN)
- Liquid Nitrogen Plant (University Cryogenic facility)
- High temperature furnaces
- FS laser system
- CW, Ti Sapphire LASER
- Microwave Vector Network Analyzer
- Circuit design and simulation laboratory
- RIE
- High resolution X-ray diffractometer
- P-E hysteresis loop tracer
- High energy ball mill, Turbo mixer, CNC machine



X-Ray Diffractometer



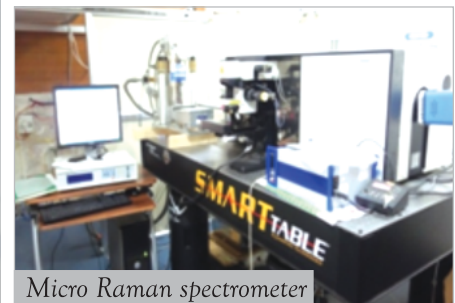
Dielectric Spectrometer



Optical Tweezers



SNOM



Micro Raman spectrometer



PLD systems with UHV, Load lock



Liquid Helium Plant



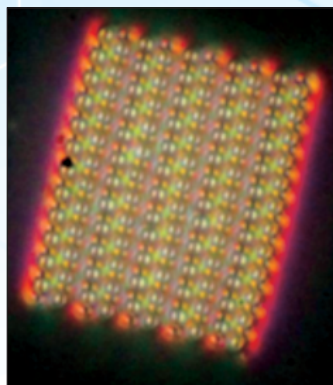
FE-Scanning electron Microscope



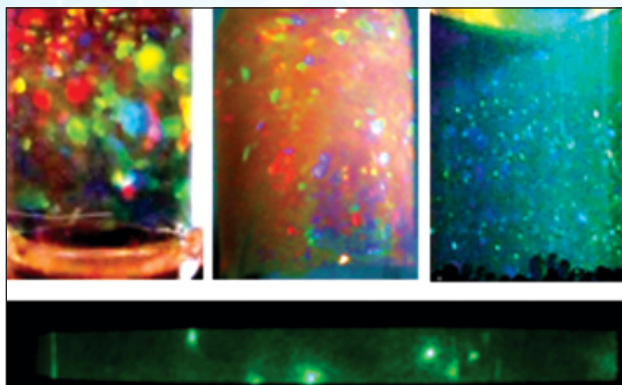
Microwave Hydrothermal Synthesis

Research Highlights

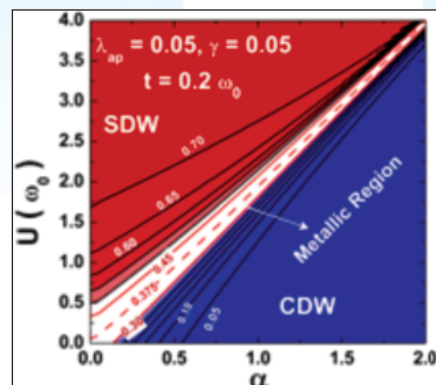
Condensed Matter Physics



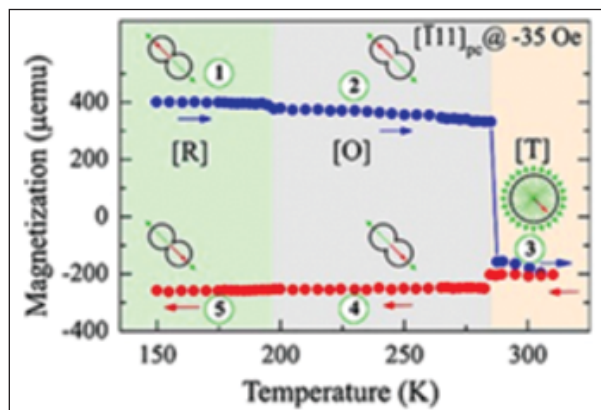
2D colloidal crystal stabilized by topological defects



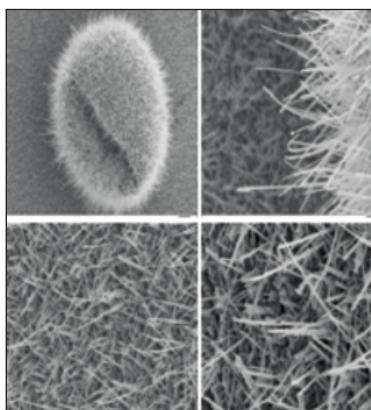
Iridescence and Bragg Diffraction from Photonic crystals self-assembled in Lab.



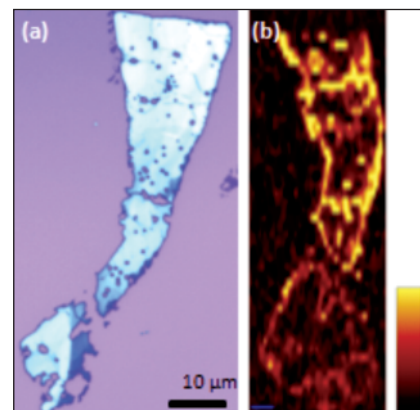
Intermediate metallic phase at CDW-SDW transition region.



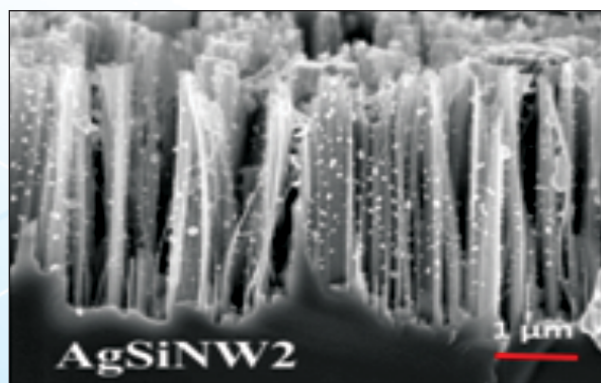
Magnetization reversal in Fe/BaTiO₃(110) heterostructured multiferroics



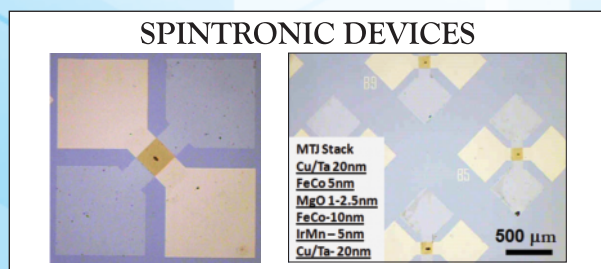
Superhydrophobic self-cleaning ZnO nanowires.



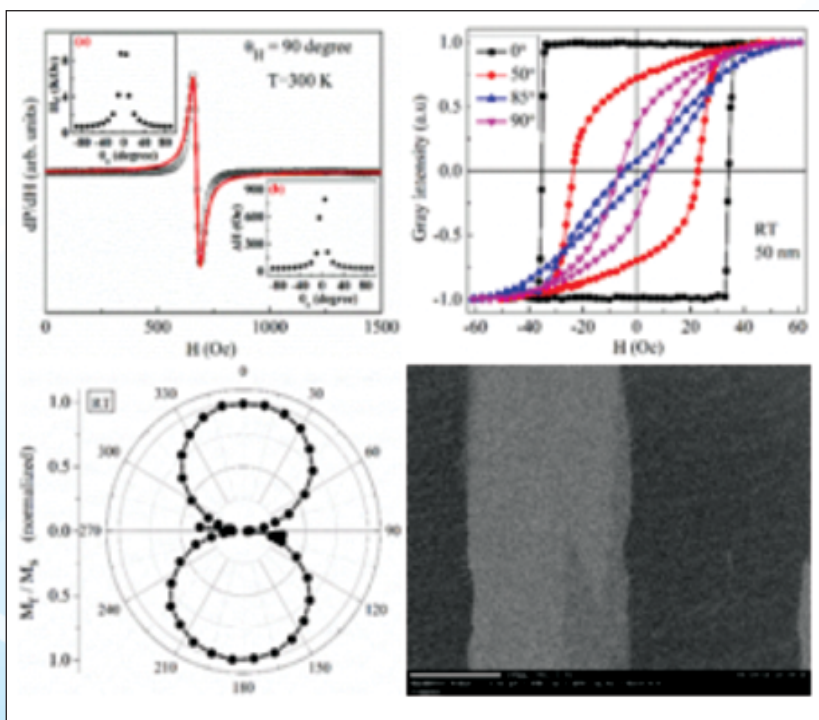
(a) Optical and (b) Raman image of exfoliated few layer graphene (FLG) after oxidation.



Ag nano-particle decorated Si nano-wire array as SERS substrate



Magnetic Tunnel Junctions on Si/SiO₂

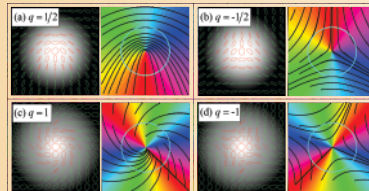


Effect of anti-site disorder in Heusler alloy (Co₂FeSi) thin films.

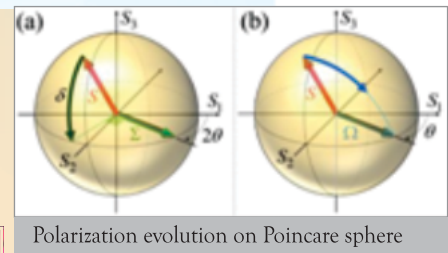
Research Highlights

Optics

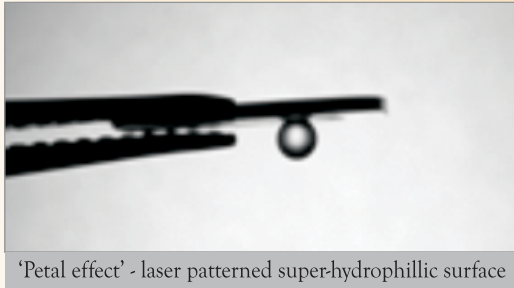
- Topologically-structured light beams,
- Spin – orbit interactions in light,
- Mimicking of quantum phenomena in classical systems.
- Topological phases achieved in structured light beams, in free space and fibers



Light's topological structures



Polarization evolution on Poincaré sphere



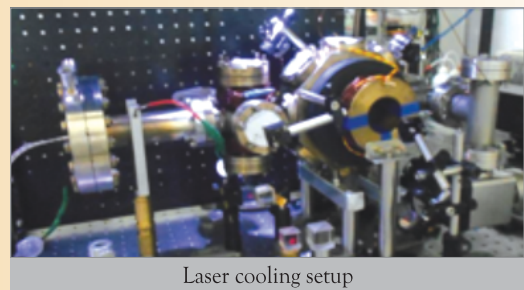
'Petal effect' - laser patterned super-hydrophilic surface

Pulsed Laser surface patterning: Perfect broad band anti-reflecting surfaces, Super hydrophobic, hydrophilic, petal effect surfaces, etc.

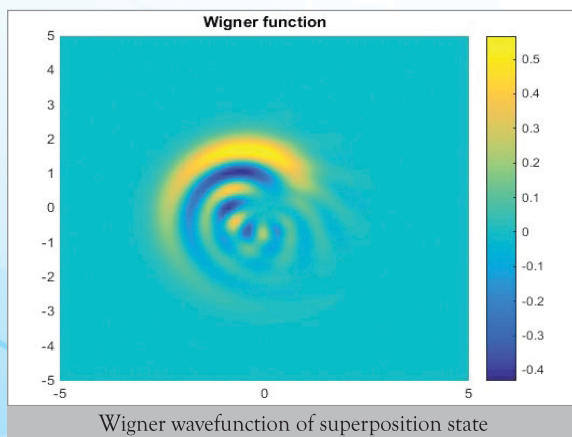
Ultrafast Spectroscopy: Two dimensional infrared spectroscopy (2DIR), pump/probe in UV, Visible, near and mid-IR regions.

Optical cooling of atoms – Lithium and Rubidium for atomic interferometry

Optical Tweezer for microrheology of complex fluids

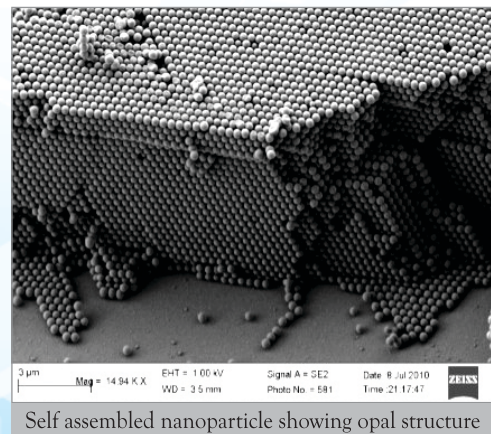


Laser cooling setup



Wigner wavefunction of superposition state

Quantum Optics – Squeezed light,
light matter interaction,
Quantum Information



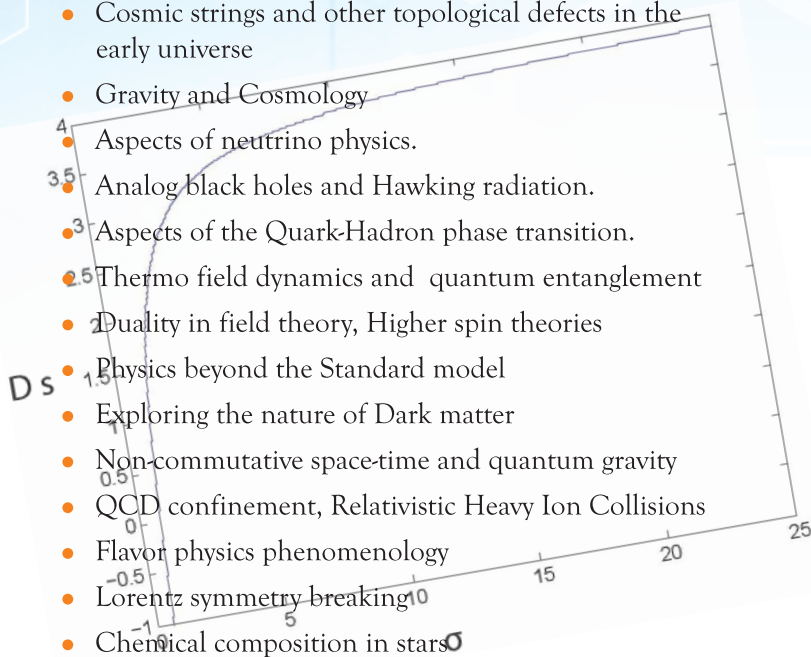
Self assembled nanoparticle showing opal structure

Photonic Crystals, Optical properties of
metamaterials, whispering gallery modes etc

Research Highlights

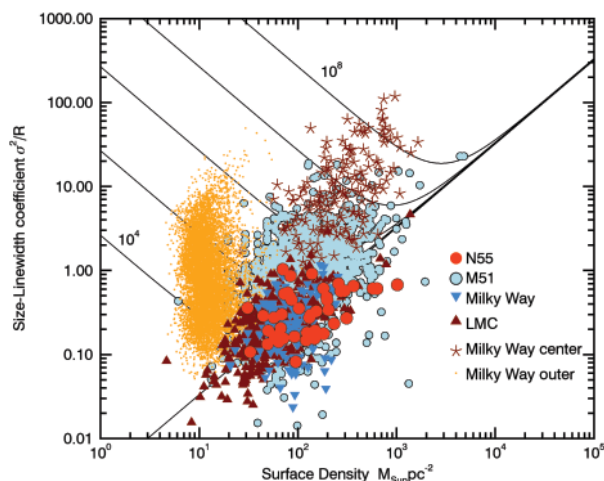
High Energy, Cosmology, Astrophysics & Field Theory

- Cosmic strings and other topological defects in the early universe
- Gravity and Cosmology
- Aspects of neutrino physics.
- Analog black holes and Hawking radiation.
- Aspects of the Quark-Hadron phase transition.
- Thermo field dynamics and quantum entanglement
- Duality in field theory, Higher spin theories
- Physics beyond the Standard model
- Exploring the nature of Dark matter
- Non-commutative space-time and quantum gravity
- QCD confinement, Relativistic Heavy Ion Collisions
- Flavor physics phenomenology
- Lorentz symmetry breaking
- Chemical composition in stars
- Massive star formation in low-metallicity galaxies with ALMA
- Search for dark matter and Invisible Higgs using CMS experiment

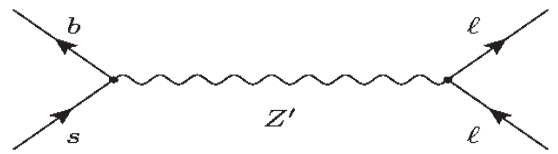


CMS Experiment at LHC, CERN
Data recorded: Sat Nov 17 17:23:56 2012 IST
Run/Event: 207454 / 1095163126
Lumi section: 771

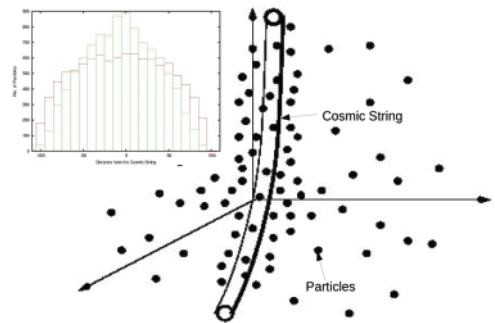
3D view of the photon pt candidate in Compact Muon Solenoid detector



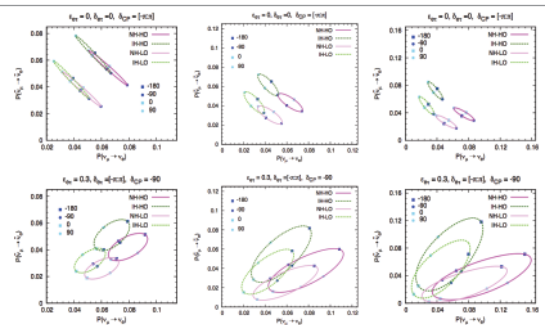
Size-linewidth coefficient σ^2/R versus surface density relation of molecular clumps.



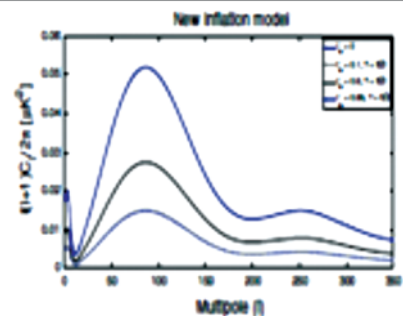
Tree level contribution of Z' to the $b \rightarrow s l \bar{l}$ effective Hamiltonian



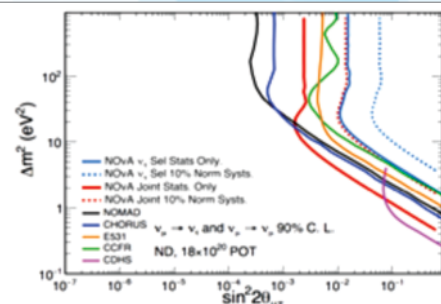
Particles clustering around a static Abelian Higgs cosmic string



The CP trajectory for T2K (left), NOVA (middle) and DUNE (right) with (bottom panel) and without (top panel) Non-standard Interactions (NSIs).



New Inflation Model



Search for exotic sterile neutrinos simulation

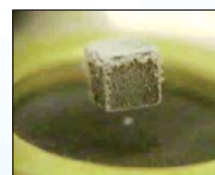
Fellowships and Awards

- Fellow of the Royal Society
- Max Born Award of the Optical Society of America
- Einstein Prize for Laser Science
- European Union Innovation Award
- Newton Award of Royal Society
- JSPS Fellowship
- MRSI medal
- Fellow of A P Academy of Science
- Fellow of I.N.S.A, I.A.S
- Shanti Swarup Bhatnagar Award
- N. S. Satya Murthy Award
- UNESCO award for Young Scientists
- Ramanujan Fellowship
- Alexander von Humboldt Fellowship
- Fellow of National Academy of Sciences
- Fellow of Institute of Physics (UK)
- Fellow of Third World Academy
- Third world academy of Women scientists
- International academy of Mathematical Physicists
- TWAS Physics prize
- Ramanna Fellowship
- Boyscast Fellowship
- Fellow of Telangana Academy of Science
- J.C. Bose Fellowship
- Swarnajayanti Fellowship
- P.M.S. Blackett Fellowship
- Commonwealth Fellowship
- Michi-Nakata Award by International Liquid Crystal Society
- Max Planck Society Fellowship
- OWSD Young Women Scientist award
- European Union Innovation Award
- DST-INSPIRE



Student activities and Outreach

- Students Organize E.T.H.E.R (Engaging Talks on Highly Exciting Research) - seminar series
- Students organize CADENCE - a seminar about their project work
- Students also take active part in regular seminars of the School
- SoP conducts national conferences every year where few faculty from the school as well as experts with in the country will deliver the talks to expose students to the frontier areas of research in Physics
- Conducting open houses to School children, research scholars and faculty from various institutions to show different Physics lab and research facilities.
- Celebrates "National Science Day" sponsored by Indian Physics Association (IPA) and School of Physics (SOP).
- Demonstration and training of Magnetic Levitation over Superconductor at various colleges & Science exhibitions; distributed levitation kits to college teachers
- Associated with "Physics Training and Talent Search Program"
- Faculty participate in Science Summer camps
- We host the National Graduate Physics Examination (NGPE) conducted by the Indian Association of Physics Teachers at the University of Hyderabad.



International Collaborations

AMERICAS

- Argonne National Labs, USA
- Boston University
- Colgate University, USA
- Cornell University, USA
- Fermi Lab, USA
- Florida state University, USA
- Jefferson National Labs
- Instituto De FISICA -UnB, BRASILIA, BRASIL
- Massachussetts Institute of Technology, USA
- NASA Goddard Space flight Centre, USA
- Rutgers University, USA
- Texas A & M University, College Station, USA
- University of Alabama, USA
- University of Colorado-Boulder, USA
- University of Oklahoma, USA
- University of South Florida, USA
- University of Rochester, USA
- University of Texas- Austin, USA
- University of Wisconsin, USA
- University of Lethbridge, Canada
- University of Puerto Rico
- Vanderbilt University

EUROPE

- Armagh Observatory, UK
- Bielefeld University, Germany
- CERN Geneva
- CEA Saclay Service d'Astrophysique, Paris
- Femto ST, Besancon, France
- Heriot -Watt University, Edinburgh, UK
- ICTP, Trieste
- Imperial College, London
- Max Plank Institute, Germany
- Jozef Stefan Institute, Slovenia
- Rudjer Boskovic Institute, Zagreb, Croatia
- Oxford University
- Technical University of Vienna, Austria
- University of Aveiro, Portugal
- University of Bristol, UK
- University of Cambridge
- Universities of Essen, Ulm, and Erlangen, Germany
- University of Mainz
- University of Manchester
- University of Trento
- Warwick University, UK

ASIA

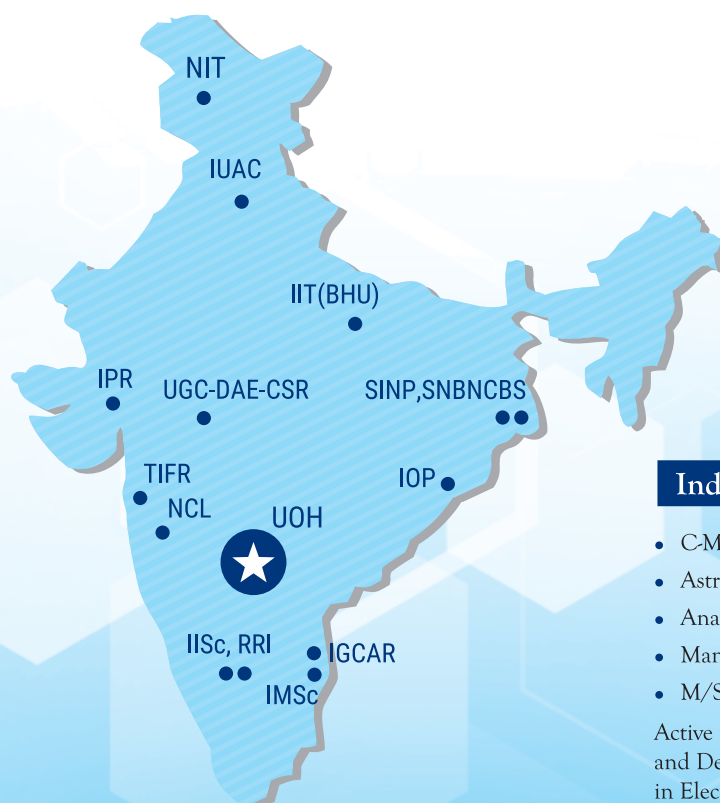
- Academia Sinica Institute of Astronomy and Astrophysics, Taiwan
- Bilkent University, Turkey
- Ankara University, Turkey
- IBS Center, Ulsan Institute of Science and Technology, South Korea
- National University of Singapore
- RIKEN, Japan
- Tokyo Institute of Technology
- Kyoto Sangyo University, Kyoto
- Nagoya University
- National Astronomical observatory of Japan
- Weizmann Institute, Israel

AUSTRALIA

- University of Melbourne
- James Cook University, Townsville, Australia

National Collaborations

- BITS Hyderabad
- DLRL, Hyderabad
- DMRL, Hyderabad
- IICT, Hyderabad
- IITH, Hyderabad
- IPR, Gujrat
- IMSc, Chennai
- NCL, Pune
- IISc, Bangalore
- IUAC, New Delhi
- IGCAR, Kalpakkam
- RCI, Hyderabad
- RRI, Bangalore
- TIFR, Mumbai
- TCIS, Hyderabad
- UGC-DAE-CSR, Indore and Mumbai



- IOP, Bhubaneswar
- IIT (BHU), Varanasi
- SINP, Kolkata
- SNBNCBS, Kolkata
- NIT, Srinagar

Industrial Collaboration

- C-MET, Hyderabad
- Astra Microwaves, Hyderabad
- Ananth Technologies, Hyderabad
- Manjeera Systems, Hyderabad
- M/S Insmart Systems

Active involvement in Technology Incubation and Development of Entrepreneurship (TIDE) in Electronics and Information technology.



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