

## Faculty

- ✦ S Banerjee, Ph.D. (TIFR, Mumbai), Condensed Matter Physics (Experiment)
- ✦ S Bhattacharjee, Ph.D. (RIKEN, Japan), Condensed Matter Physics (Experiment)
- ✦ K Bhattacharya, Ph.D. (SINP, Calcutta) Condensed Matter Physics (Theory)
- ✦ R C Budhani, Ph.D. (IIT, Delhi), Condensed Matter Physics (Experiment)
- ✦ D Chowdhury, Ph.D. (IIT, Kanpur), Condensed Matter & Statistical Physics (Theory)
- ✦ S. Dhamodaran, Ph.D. (Hyderabad), Nuclear Physics (Experiment)
- ✦ A Dutta, Ph.D. (SINP, Kolkata), Condensed Matter Physics (Theory)
- ✦ T K Ghosh, Ph.D. (IMSc, Chennai), Condensed Matter Physics (Theory)
- ✦ A K Gupta, Ph.D. (Kentucky), Condensed Matter Physics (Experiment)
- ✦ M K Harbola, Ph.D. (CUNY), Condensed Matter Physics (Theory)
- ✦ Z Hossain, Ph.D. (TIFR, Mumbai), Condensed Matter Physics (Experiment)
- ✦ P Jain, Ph.D. (Syracuse), High Energy Physics (Theory)
- ✦ S D Joglekar, Ph.D. (Stony Brook), High Energy Physics (Theory)
- ✦ V N Kulkarni, Ph.D. (Marathwada), Nuclear Physics & Material Science (Experiment)
- ✦ S Kumar, Ph.D. (IIT, Delhi), Condensed Matter Physics (Experiment)
- ✦ Y N Mohapatra, Ph.D. (IISc, Bangalore), Condensed Matter Physics (Experiment)
- ✦ S Mukherji, Ph.D. (IOP, Bhubaneswar), Condensed Matter & Statistical Physics (Theory)
- ✦ A Pradhan, Ph.D. (CUNY), Laser Spectroscopy & Medical Applications (Experiment)
- ✦ R Prasad, Ph.D. (Roorkee), Condensed Matter Physics (Theory)
- ✦ K P Rajeev, Ph.D. (IISc, Bangalore), Condensed Matter Physics (Experiment)
- ✦ S A Ramakrishna, (RRI, Bangalore), Condensed Matter Physics & Optics (Theory)
- ✦ V Ravishankar, Ph.D. (Mysore), High Energy Physics (Theory)

- ✦ S Raychaudhuri, Ph.D. (Calcutta), High Energy Physics (Theory)
- ✦ D Sahdev, Ph.D. (Case Western), High Energy Physics (Theory)
- ✦ T Sarkar, Ph.D. (IMSc, Chennai), High Energy Physics (Theory)
- ✦ G. Sengupta, Ph.D. (IOP, Bhubaneswar), High Energy Physics (Theory)
- ✦ K Shahi, Ph.D. (Gorakhpur), Condensed Matter Physics (Experiment)
- ✦ A Singh, Ph.D. (Urbana-Champaign), Condensed Matter Physics (Theory)
- ✦ V Subrahmanyam, Ph.D. (TIFR, Mumbai), Condensed Matter Physics (Theory)
- ✦ R K Thareja, Ph.D. (Delhi), Laser Physics (Experiment)
- ✦ H C Verma, Ph.D. (IIT, Kanpur), Nuclear Physics (Experiment)
- ✦ M K Verma, Ph.D. (Maryland), Turbulence & Plasma Physics (Theory)
- ✦ H Wanare, Ph.D. (Hyderabad), Nonlinear Optics (Theory)

### EMERITUS PROFESSOR

- ✦ S C Agarwal, Ph.D. (Chicago), Condensed Matter Physics (Experiment)

### DISTINGUISHED HONORARY PROFESSORS

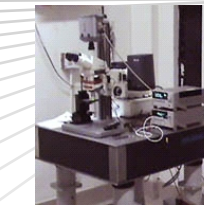
- ✦ G K Mehta (NSC, Delhi), Nuclear Physics (Experiment)
- ✦ T V Ramakrishnan (BHU), Condensed Matter Physics (Theory)

### VISITING FACULTY

- ✦ S Auluck, Ph.D. (Chicago), Condensed Matter Physics (Theory)

# Indian Institute of IITK Technology Kanpur

## Department of Physics



The Department of Physics at IIT, Kanpur may lay a fair claim to be India's premier physics department. In the last five decades, it has produced a steady stream of brilliant scientists, who have gone on to win academic laurels in many fields of research. Perhaps more significantly, the Department has steadily been making important research contributions in various front-line areas of physics. Roughly half the faculty are studying the physics of Condensed Matter systems, while the other half includes active groups working in theoretical High Energy Physics, Lasers & Quantum Optics, and Ion Beam and Nuclear Solid State Physics. With this highly desired combination of teaching and research at the highest levels, it is probably fair to say that the Department sets the standard for physics departments in the country.

The Department has at present 34 members in the Faculty, two Distinguished Honorary Professors, and one visiting Faculty. There are at present 94 Ph.D. scholars engaged in doctoral research with various members of the faculty. The faculty is assisted by a team of Senior Scientific Officers, Research Associates and Postdoctoral Fellows as part of the academic staff. We have about 111 undergraduate students in three programmes: 73 are in the Integrated (Five-year) M.Sc. programme, 28 in the M.Sc. (Two-year) programme, and 47 of the total 94 Ph.D. students in the Integrated M.Sc.-Ph.D. (Dual Degree) programme.



### Contact us:

If you have any queries, you are welcome to contact the Head of the Department,

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## Areas of Research

### Broad Areas of Research

- Condensed Matter Physics (Experiment)
- Condensed Matter, Non-linear and Statistical Physics (Theory)
- High Energy Physics (Theory)
- Laser Physics and Quantum Optics
- Ion Beams & Nuclear Solid State Physics

### Thrust Areas

- ✦ Origin & Ultimate Constituents of the Universe
- ✦ Self-Assembled Soft Materials and Self-organizing Complex Processes
- ✦ Novel Semiconductor Materials and Organic Electronics
- ✦ Magnetism & Spintronic Materials
- ✦ Nanomaterials & Metamaterials
- ✦ Strongly Correlated Systems
- ✦ Optical Physics at ultra-short time scales, Nano-Bio Photonics
- ✦ Nonlinear Dynamics & Computational Physics
- ✦ Imaging of Electronic Properties
- ✦ Biological & Medical Physics
- ✦ Display Materials

# Salient Features

## Inter-disciplinary Nature

- Physics Department participates in
  - Laser Technology Programme
  - Materials Science Programme
  - Samtel Centre for Display Technologies
  - DST Unit on Nanoscience
  - Centre for Nanotechnology

## Laboratories

- Low Temperature Laboratory
- Magnetism Laboratory
- Semiconductor Laboratory
- Laser Laboratories
- Central Nuclear Laboratories
- Solid State Ionics Laboratories
- Imaging Laboratories
- Central EPR Laboratory

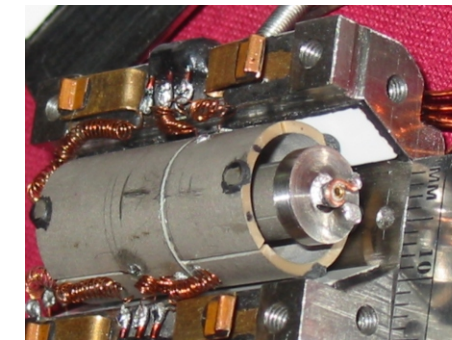
## Central Facilities

### Liquid Nitrogen Plant

- Stirling Model MNP-20 Capacity 20 litre/hr.

### Liquid Helium Plant

- Linde Liquifier Model 1610
- Koch Processes, Model 1401
- Liquid nitrogen and helium are made available to outside users also.



# Facilities Available

✦ **Low Temperature Laboratory:** Nitrogen and Helium Liquefiers, Superconducting magnets, Closed cycle Helium Refrigerators, Experimental Setup for Resistivity, Hall Effect and Magnetic Susceptibility, Magnetoresistance, Specific Heat, Thermoelectric Power, Tunneling Conductance, Magnetostriction.

✦ **SQUID Facility:** The Superconducting Quantum Interference Device (SQUID) based Magnetic Properties Measurement System (MPMS) (5T, 1.7K-350K). The facility also has a Physical Properties Measurements System (PPMS), with magnetic fields up to 14T and temperatures down to 0.3K.

✦ **Magnetism Laboratory:** Mossbauer Spectrometer, Vibrating Sample Magnetometer, EPR Spectrometer with variable temperature accessory.

✦ **Laser Laboratories:** Argon ion lasers, Ring Dye lasers, ND:YAG lasers, Excimer Laser, Home-made 100 W CO<sub>2</sub> laser, Electron-Beam System, Double Monochromators, Photon Counters, Box Car Averagers, Vibration free tables. Facilities exist for High Resolution Spectroscopy, Raman and Micro-Raman Spectroscopy, Laser-Plasma Studies and Nonlinear Optics, Semiconductor Lasers and Biological imaging.

✦ **Ion Beam and Nuclear Techniques Laboratory:** Focused Ion Beam System (Nova Lab 600) for Nano Microfabrication. A modern 1.7 MV Tandemtron accelerator is being installed with capabilities of producing ion beams of all most all elemental species. The facility is equipped with a nuclear microprobe station for science and engineering application such as proton and heavy ion beam writing, RBS, PIXE and ion Channeling E-beam deposition, Positron Annihilation, Mossbauer Studies at Low Temperatures.

✦ **Computational Facility:** The Department has a computer lab with many high-end Pentiums and dedicated server. High performance computing facilities based on modern clusters are being installed in the Department. The Computer Centre, a central facility at the Institute has two super computers (IBM-SP2, PARAM) in addition to many workstations and pentiums.

✦ **Low Dimensional Systems Laboratory:** Pulsed Excimer Laser ablation facility for synthesis of magnetic, superconducting and dielectric superlattices. Transport measurements at low temperature (4.2K) and high field (4 Tesla). High frequency measurements of vortex dynamics in superconductors. Laser based pump probe measurements.

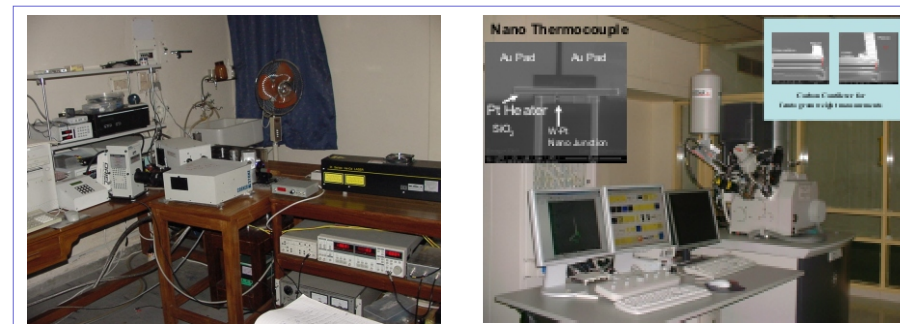
✦ **Semiconductor Laboratories:** Well equipped facilities have been setup for optoelectronic characterization of semiconductor materials and devices including amorphous and nanocrystalline materials. State of the art search facilities for organic semiconductors for OLED, TFT, Solar Cell, Printable Electronics.

# Research Projects

- ✦ Development of next generation plasma display technology and 50 inch HD-PDP prototype (CSIR, 2007)
- ✦ Developing a high sensitivity magneto-optical imaging technique (DST, 2007)
- ✦ Oxide based functional thin film nanostructure for spintronics & quantum information (DIT, 2007)
- ✦ Synthesis and investigation of YP- based strongly correlated electron systems (BRNS, 2007)
- ✦ Ion beam facility for micro and nanoscale science and engineering (DST, 2006)
- ✦ Ramanna fellowship (DST, 2006)
- ✦ Terahertz waves using high density plasma sources (AOARD, 2006)
- ✦ Spintronic materials-magnetic and superconducting thin film heterostructures for spintronics (DAE, 2006)
- ✦ Study of large scale cosmic anisotropy in the radio and optical polarizations from active galactic nuclei and cmbr (DST, 2006)
- ✦ Imaging phase separation in CMR materials (AOARD, 2006)
- ✦ A combined approach to diagnose cervical and oral cancer using polarized Raman intrinsic fluorescence spectroscopy (CSIR, 2006)
- ✦ STM studies of strongly correlated transition metal oxides (DST, 2006)
- ✦ Liquid Helium Plant: Financial assistance to the department of physics iitk on fist program (DST, 2006)
- ✦ Novel electrodynamic of negative refractive index materials (DST, 2005)
- ✦ Development of magnesium oxide coatings by sputtering for plasma display panels (MCIT 2005)
- ✦ Preparation and characterization of temperature sensor based on single crystal fibres (MHRD, 2005)
- ✦ Development of prototype full color organic light emitting diode (OLED) display (DST, 2005)
- ✦ Development of oxides-based nano-materials for electro-optical applications (DRDO, 2005)
- ✦ Studies of vortex dynamics and dissipation in two dimensional superconductors (CSIR, 2004)
- ✦ Theoretical studies of quantum interference effects in 4-level atomic systems (DST, 2004)
- ✦ Fundamental studies on manganese oxides and analogs for suitability as cathodes in rechargeable lithium ion batteries (RCI, 2004)
- ✦ Development of a green laser based on single crystal fibers (DRDO, 2004)
- ✦ Spintronics in magnetic thin films of transition metal oxides (DRDO, 2003)
- ✦ Study of potential fluctuations in amorphous silicon (DST, 2003)
- ✦ UV laser and band gap engineered sensors based upon ZnO (DRDO, 2003)
- ✦ Development of photonic devices based on single crystal fibers (DIT, 2003)
- ✦ Development of open ended experiments in physics at school level (VP, 2003)
- ✦ Intrinsic fluorescence of tissues for diagnosis of cancer (DAE, 2003)
- ✦ Laser molecular beam epitaxy of superconducting magnetic and semiconducting metal nitrides (DST, 2002)
- ✦ Radiation induced electronic phase separation in epitaxial films of perovskite manganites (IFCPAR, 2002)

The Department has been running/participating in 5 teaching programmes, viz.

- ✦ Core Teaching Programme (for all undergraduate students)
- ✦ Integrated (5-year) M.Sc. Programme in Physics (Admission through IIT-JEE)
- ✦ Two-Year M.Sc. Programme in Physics (Admission through JAM after B.Sc.)
- ✦ Ph.D. Programme in Physics (GATE/CSIR/UGC/NET required for Entrance Exam at IITK)
- ✦ Integrated M.Sc.-Ph.D. (Dual degree) Programme in Physics (Admission through JAM after B.Sc.)



# Books

- ✦ **S.D. Joglekar, 'Mathematical Physics: Advanced Topics',** Universities Press, Hyderabad, 2006.
- ✦ **H.C. Verma, 'Quantum Physics':** Surya Publications, Ghaziabad, 2006.
- ✦ **S.D. Joglekar, 'Mathematical Physics: The Basics,'** Universities Press 2004.
- ✦ **V.A. Singh et al., 'Physics, Class XI,'** NCERT Publications, New Delhi, 2002.
- ✦ **D. Chowdhury and D. Stauffer, 'Principles of Equilibrium Statistical Mechanics,'** Wiley-VCH, Germany, 2000.
- ✦ **Tulsi Dass and S.K. Sharma, 'Mathematical Methods in Classical and Quantum Physics,'** Universities Press (India) Ltd, Hyderabad, 1998.
- ✦ **J.K. Bhattacharjee and A.K. Mallik (Eds), 'Complex Systems,'** IITK Series, Narosa, New Delhi, 1995.
- ✦ **D. Saran, 'Problems in Physics,'** A.H. Wheeler, Allahabad, 1994.
- ✦ **Tulsi Dass, 'Symmetries, Gauge Fields, Strings and Fundamental Interactions,'** Vol. I, Wiley Eastern Ltd, New Delhi, 1993.
- ✦ **K. Sriram and Y.R. Waghmare, 'Introduction to Nuclear Science and Technology,'** A.H. Wheeler, Allahabad, 1991.
- ✦ **B.K. Sharma, P.C. Jain and R.M. Singru (Eds), 'Positron Annihilation and Compton Scattering,'** Omega Scientific Publishers, New Delhi, 1990.
- ✦ **Y.R. Waghmare, 'Introduction to Quantum Mechanics,'** S Chand, New Delhi.
- ✦ **Y.R. Waghmare, 'Introduction to Nuclear Physics,'** Oxford/IBH, New Delhi.
- ✦ **Y.R. Waghmare and S.N. Muherji, 'Physics of Rotating Nuclei,'** New Age International Publications, New Delhi.
- ✦ **Y.R. Waghmare, 'Fundamentals of Quantum Mechanics,'** A.H. Wheeler, Allahabad.
- ✦ **Y.R. Waghmare, 'Classical Mechanics,'** Prentice Hall of India, New Delhi, 1990
- ✦ **R. Waghmare, 'Understanding Special Theory of Relativity,'** Vikas, New Delhi, 1990.
- ✦ **D. Chowdhury, 'Spin Glasses and other frustrated Systems,'** World Scientific Publishing Co, Singapore, 1986.
- ✦ **H.S. Mani and G.K. Mehta, 'Introduction to Modern Physics,'** Affiliated East-West Pvt Ltd, New Delhi, 198
- ✦ **T.R. Visvanathan, G.K. Mehta and V. Rajaraman, 'Electronics for Scientists and Engineers,'** Prentice-Hall India Pvt Ltd., New Delhi, 1978.

