MHRD scheme on Global Initiative for Academic Network (GIAN)

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From December 12 to 16, 2016

School of Physical Sciences, Jawaharlal Nehru University, New Delhi-110067, INDIA

Quantum Transport: Atom to Transistor

What the course is about:

The modern smartphone is enabled by a billion-plus nanotransistors, each having an active region that is barely a few hundred atoms long. Interestingly the same amazing technology has also led to a deeper understanding of the nature of current flow on an atomic scale and my aim is to make these lessons from nanoelectronics accessible to anyone in any branch of science or engineering. Overall I hope to show that the lessons of nanoelectronics lead naturally to a new viewpoint, one that changes even some basic concepts we all learn in freshman physics. This unique viewpoint not only clarifies many old questions but also provides a powerful approach to new questions at the frontier of modern nanoelectronics, such as how devices can be built to control the spin of electrons.

Course Materials:

Lessons from Nanoelectronics: A New Perspective on Transport, World Scientific 2012; II Edition to appear in 2017 (manuscript should be available). Much of the course material is available on nanoHUB: https://nanohub.org/courses/fon1, fon2. We assume very little background beyond linear algebra and differential equations, although we will discuss advanced concepts in non-equilibrium statistical mechanics of interest even to specialists.

Schedule:

Dec.12-13: Part 1 (Basic Concepts) introduces a new perspective connecting the quantized conductance of short ballistic conductors to the familiar Ohm's law of long diffusive conductors, along with fundamental conceptual issues related to the meaning of resistance on an atomic scale and the interconversion of electricity and heat. **Dec.14-15:** Part 2 (Quantum Transport) introduces the Non-Equilibrium Green's Function (NEGF) method using a unique one-electron approach, and illustrates it with interesting applications including the latest developments in spintronics. **Dec.16:** Current research topics in the post Moore's law era.

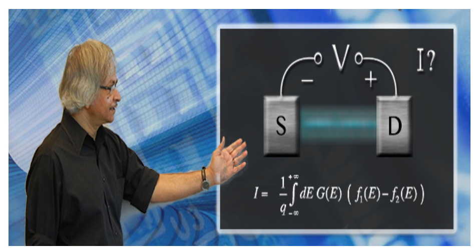
Registration: ***Number of participants limited to 100***

JNU M.Sc./M.A. students – Free, Research Students (M.Phil. &Ph.D.) and Faculty: Rs. 1000/-

Other recognized educational institutions: Students Rs. 1000/- Faculty: Rs. 2000/-
Members of Industry or Private Research Institutions: Rs. 10,000/-
Members of Government Research Institution: Rs. 5000/-, Participants from abroad: US $500

Teaching Faculty:

Prof. Supriyo Datta



Supriyo Datta is the Thomas Duncan Distinguished Professor at Purdue University. The approach pioneered by his group for the description of quantum transport has been widely adopted in the field of nano electronics. This approach, combining the non-equilibrium Green function (NEGF) formalism of many-body physics with the Landauer formalism from mesoscopic physics, is described in his books, Electronic Transport in Mesoscopic Systems, Cambridge 1995 and Quantum Transport: Atom to Transistor, Cambridge 2005.He is also well-known for his contributions to molecular electronics and spintronics.

Course Coordinator:

Prof. Subhasis Ghosh:

Subhasis Ghosh is professor of physics in School of Physical Sciences, Jawaharlal Nehru University, New Delhi. The significant contribution by his group is the development of fundamental understanding of transport and optical properties of technologically important inorganic (GaN and GaAs) and organic (molecular and Graphene) semiconducting materials in their bulk-phase as well as nano-phase and extend them to applied areas of research for the development of novel devices. He enjoys teaching different courses like, classical mechanics, solid state physics, statistical mechanics, computation physics, physics at nanoscale and physics of semiconductor devices.

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