



up
bottom
from the
ELECTRONICS

WHAT:

NCN's Electronics from the Bottom Up - an innovative educational initiative cosponsored by Intel, NCN, and Purdue University - introduces students to new ways of thinking about electronic devices. New concepts and approaches, emerging from current research on nanoscience, are applied to non-equilibrium problems like nanoscale transistors, energy conversion devices and bio-sensors. The 2010 Summer School will feature lectures and hands on exercises by Prof. Supriyo Datta on the topic: "Nanoelectronic Devices, with an introduction to spintronics." Additional tutorials on selected topics will be presented by faculty from Purdue University and from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in Bangalore, India.

For registration: www.conf.purdue.edu/nano

WHEN:

July 12-16, 2010

WHERE:

Purdue University - West Lafayette, IN, USA

WHO:

Graduate students, faculty, and industry professionals working on electronic materials and devices. The Summer School will be an intensive and collaborative experience. Attendance is limited to fifty participants.

TOPIC:

This year's summer school will have two components: a focus on nanoelectronic devices, with an introduction to spintronics and, second, tutorials on selected topics in nanotechnology. First, we use our bottom-up approach to provide a clear perspective on quantum conduction, on converting heat to electricity and its relation to the second law of thermodynamics, and on what recent experiments in electron spin say about subtleties of the quantum world and how it can be utilized for information processing. Our selected topics in nanotechnology include far-from-equilibrium quantum charge transport, electrical fluctuations, nanoscale material simulation, and heat transfer.

"A useful and fun summer school!"

"I now have new point of view and better understanding."

"Excellently organized school!"

- Participants, 2009

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MORE**

Explore NCN's Electronics from the Bottom Up and previous summer school materials at:
http://www.nanohub.org/topics/electronics_from_the_bottom_up

CURRICULUM

Lecture 1a: Atom to Transistor: A Semi-Classical View (Datta)

Lecture 1b: Nanotransistors: A Bottom-Up View (Lundstrom)

Lecture 2: Quantum of Conductance: Resistance and Uncertainty (Datta)

Exercise Session 1 (Datta)

Lecture 3: Thermoelectricity: Energy from Heat (Datta)

Lecture 4: Maxwell's Demon: Energy from Information (Datta)

Exercise Session 2 (Datta)

Lecture 5: Electron Spin: How to Rotate an Electron to Control the Current (Datta)

Lecture 6: The Spin Transistor and Beyond (Datta)

Exercise Session 3 (Datta)

Tutorial 1: Electrical Fluctuations at the Nanoscale (Vidhyadhiraja)

Tutorial 2: A Bottom-Up View of Heat Transfer in Nanomaterials (Fisher)

Tutorials 3a, 3b, 3c: Materials Simulation by First-Principles Density Functional Theory (Waghmare)

Tutorials 4a, 4b: Far-From-Equilibrium Quantum Transport (Klimeck)

INSTRUCTORS

Supriyo Datta is the Thomas Duncan Distinguished Professor of Electrical and Computer Engineering at Purdue University and has received IEEE Technical Field Awards for both research and graduate teaching. His unique approach to the problem of quantum transport combining the non-equilibrium Green function (NEGF) formalism of many-body physics with the Landauer formalism from mesoscopic physics has been widely adopted in the field of nanoelectronics.

Umesh Waghmare received his undergraduate degree in Engineering Physics from Indian Institute of Technology, Bombay and his PhD in Applied Physics from Yale University, followed by postdoctoral research in Physics at Harvard University. He is a professor in Theoretical Sciences Unit at Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore, working on Theory of Materials.

Gerhard Klimeck is a Professor of Electrical and Computer Engineering and the Director of the Network for Computational Nanotechnology (NCN) at Purdue University. NCN operates nanoHUB.org serving over 100,000 users annually.

Mark Lundstrom is the Don and Carol Scifres Distinguished Professor of Electrical and Computer Engineering at Purdue University. His research uses theory, modeling, and computer simulation to explore the physics and ultimate limits of electronic devices. Lundstrom is known for his pioneering studies of carrier transport in nanoscale transistors.

Vidhyadhiraja Sudhindra received a PhD from the Physics Department, Indian Institute of Science, Bangalore in 2001. He was a postdoctoral fellow at the Physical and Theoretical Chemistry Laboratory at the University of Oxford, UK from 2001 to 2005. Since then, he has served as a faculty member at the Theoretical Sciences Unit of the JNCASR, Bangalore.

Timothy S. Fisher is a Professor of Mechanical Engineering at Purdue University. In 2008 he was a Visiting Professor at the JNCASR, Bangalore, and is now an Adjunct Professor at JNCASR. This year he is a Research Scientist at the Air Force Research Laboratory's newly formed Thermal Sciences and Materials Branch of the Materials and Manufacturing Directorate.