PURDUE UNIVERSITY NCN

summer school 2009

up bottom from the ELECTRONICS

What:

Electronics from the Bottom Up – an innovative educational initiative co-sponsored by Intel, NCN, and Purdue University – introduces students to a new way of thinking about the opportunities and fundamental limits of nanoscale electronics – from mainstream CMOS to emerging devices. This new approach prepares students broadly to realize the potential of emerging nanoscale devices for electronic switching, flexible electronics, energy conversion, and biosensing. The summer 2009 course focus is on reliability physics and graphene devices.

When:

July 20-24, 2009

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:

Mornings: Reliability Physics of Nanoelectronic Devices, by M. A. Alam (two lectures per morning)

Afternoons: Colloquium on Graphene Physics and Devices by S. Datta, M. Lundstrom and J. Appenzeller (one lecture per day)

Hands-on laboratory session on reliability physics

"The quality of the lectures was excellent!"

"Good physical insight and important ideas were conveyed in a short time."

"I really enjoyed it."

- Participants, 2008

Learn More:

Explore the curriculum and previous summer school materials at:

http://www.nanohub.org/topics/electronics_from_the_bottom_up

https://www.ncn.purdue.edu/workshops/2009summerschool/

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July 20-24 2009 Curriculum at-a-glance

Mornings

Lecture 1a:	A Brief History of Reliability Physics
Lecture 1b:	Basics of Reliability: A stochastic process terminated by a threshold
Exercise:	A MATLAB code to explore the predictions of the toy model.
Lecture 1c:	Classification of Reliability Issues
Lecture 2a:	Negative Bias Temperature Instability.
Lecture 2b:	Circuit Implications of Negative Bias Temperature Instability
Lecture 3a.	Mechanics of Gate Dielectric Breakdown
Exercise:	2D and 3D percolation models comparing theory and experiment.
Lecture 4a:	Hot carrier degradation/Correlated breakdown
Exercises:	Using the MATLAB code to explore bond-dispersion model
Lecture 4b:	Radiation Induced Soft and Hard Faults
Lecture 5	The Future of Electronic Reliability

Afternoons

Preview:	An Experimentalist's Perspective on Graphene Nanoelectronics Joerg Appenzeller
Lecture 1:	A Review of Electronics from the Bottom Up Supriyo Datta
Lecture 2:	Electronic Structure of Graphene Supriyo Datta
Lecture 3:	Conductance vs. Fermi Level of Graphene Mark Lundstrom
Lecture 4:	NEGF treatment of Graphene Nanodevices / Contacts Supriyo Datta
Lecture 5:	Graphene PN Junctions / Electron Focusing in Graphene Mark Lundstrom
Postscript:	Percolative Transport in Graphene

Instructors

Ashraf Alam is a professor of Electrical and Computer Engineering at Purdue University, and the recipient of the IEEE Electron Device Society PhD Fellowship. Professor Alam has spent nearly a decade in industry, first at Bell Labs and then at Agere Systems. His research areas include physics of electronic, optoelectronic, and bioelectronic devices, transport in homogeneous systems, reliability limits of CMOS devices, and computational modeling.

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-equlibrium Green function (NEGF) formalism of many-body physics with the Landauer formalism from mesoscopic physics has been widely adopted in the field of nanoelectronics.

Mark Lundstrom is Director of the Network for Computational Nanotechnology and 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.

Joerg Appenzeller is a Professor of Electrical and Computer Engineering at Purdue University and Scientific Director of Nanoelectronics in the Birck Nanotechnology Center. His research areas include device and transport physics of low-dimensional systems, experimental verification of novel device concepts for improved transistor performance, exploration of nano-materials and nano-interfaces for future nanoelectronics applications. Before coming to Purdue, he was with the IBM T.J. Watson Research Center, Yorktown, NY, as a Research Staff Member mainly involved in the investigation of the potential of carbon nanotubes for future nanoelectronics.