

## The Micro and Nanotechnology Laboratory

**The Micro and Nanotechnology Laboratory**, with 147,347 square feet of space, is one of the nation's largest and most sophisticated university-based facilities for semiconductor, nanotechnology, and biotechnology research. It contains more than 8,000 square feet of class 100 and class 1000 cleanroom laboratories, a new 3,000 square-foot laboratory complex specifically designed for bionanotechnology, and state-of-the-art ultra-high-speed optical and electrical device and circuit measurement equipment. The bionanosystems area focuses on utilizing the various technologies developed in materials, nanofabrication, devices, MEMS, and NEMS to study and solve biological issues.

### Multidisciplinary research is carried out in four key areas:

- **Micro and Nanoelectronics**
- **Nanophotonics and Optoelectronics**
- **Nanomedicine and BioNanotechnology**
- **MEMS/NEMS and Integrated Systems**

Please visit the Micro and Nanotechnology Laboratory website for a list of research groups, faculty, and centers, along with updates on activities and accomplishments

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#### Micro and Nanoelectronics

Ilesanmi Adesida, K. Y. Norman Cheng, Kent Choquette, James J. Coleman, Milton Feng, Matthew Gilbert, Lynford L. Goddard, Nick Holonyak, Jr., Kuang-Chien Hsieh, Xiuling Li, Eric Pop

#### Nanophotonics and Optoelectronics

Ilesanmi Adesida, K. Y. Norman Cheng, Kent Choquette, Shun Lien Chuang, James J. Coleman, Milton Feng, Matthew Gilbert, Lynford L. Goddard, Nick Holonyak, Jr., Kuang-Chien Hsieh, Xiuling Li, Eric Pop

#### Nanomedicine and BioNanotechnology

Irfan Ahmad, Rashid Bashir, Brian T. Cunningham, Logan Liu

#### MEMS/NEMS and Integrated Systems

Irfan Ahmad, Rashid Bashir, James J. Coleman, Brian T. Cunningham, Milton Feng, Logan Liu

### Micro and Nanotechnology Laboratory

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### **MNTL Building Receives AIA Illinois Frank Lloyd Wright Award**

The design for the recently expanded Micro and Nanotechnology Laboratory (MNTL) was selected for the American Institute of Architects–Illinois Frank Lloyd Wright Award (Citation of Merit).

The \$18 million expansion project—designed by Teng and Associates (Thomas Hoepf, FAIA, Principal Design Architect)—was officially dedicated in September. The primary contractors for the expansion project included the Illinois firms of Teng & Associates, Chicago, Henneman Engineering, Inc., Champaign, CORE Construction, Morton, A & R Services, Urbana, Coleman Electric, Mansfield, and F. J. Murphy, Springfield.

The AIA Illinois 2008 Honor Awards: A Celebration of Better Illinois Communities by Design recognized the people and projects representing the best of the architecture profession, the power of design, and the dedication of individuals to service and excellence. All award winners exemplify positive impacts on regions great and small and help create more livable communities in Illinois.

## Resident Faculty of the Micro and Nanotechnology Laboratory

Brief summaries are provided on the pages listed.

Please check the MNTL website for updates on activities and accomplishments.

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## Part-time Resident Faculty\*

**Rohit Bhargava**, Bioengineering (rxb@illinois.edu; cisl.bioen.illinois.edu)

**Kanti Jain**, Electrical and Computer Engineering (kjain@illinois.edu; pmml.ece.illinois.edu)

**Iwona Jasiuk**, Mechanical Science and Engineering (ijasiuk@illinois.edu)

**Gregory Timp**, Electrical and Computer Engineering (gtimp@illinois.edu)

## Affiliate Faculty\*

**John Abelson**  
Materials Science and Engineering

**Leslie Allen**  
Materials Science and Engineering

**Paul Braun**  
Materials Science and Engineering

**Raffi Budakian**  
Physics

**Ioannis Chasiotis**  
Aerospace Engineering

**Hyungsoo Choi**  
Electrical and Computer Engineering

**James Economy**  
Materials Science and Engineering

**J. Gary Eden**  
Electrical and Computer Engineering

**Nicholas Fang**  
Mechanical Science and Engineering

**Placid Ferreira**  
Mechanical Science and Engineering

**Paul Hergenrother**  
Chemistry

**Anthony Jacobi**  
Mechanical Science and Engineering

**Shiv Kapoor**  
Mechanical Science and Engineering

**Linda Katehi**  
Electrical and Computer Engineering

**Kevin Kim**  
Electrical and Computer Engineering

**William King**  
Mechanical Science and Engineering

**Hyunjoon Kong**  
Chemical and Biomolecular Engineering

**Mary Kraft**  
Chemical and Biomolecular Engineering

**Paul Kwiat**  
Physics

**Jean-Pierre Leburton**  
Electrical and Computer Engineering

**Richard Masel**  
Chemical and Biomolecular Engineering

**Nadya Mason**  
Physics

**George Miley**  
Nuclear, Plasma, and Radiological Engineering

**Ralph Nuzzo**  
Chemistry

**Umberto Ravioli**  
Electrical and Computer Engineering

**John Rogers**  
Materials Science and Engineering

**David Ruzic**  
Nuclear, Plasma, and Radiological Engineering

**Taher Saif**  
Mechanical Science and Engineering

**Larry Schook**  
Animal Sciences

**Edmund Seebauer**  
Chemical and Biomolecular Engineering

**Mark Shannon**  
Mechanical Science and Engineering

**Sanjiv Sinha**  
Mechanical Science and Engineering

**Stephen Sligar**  
Biochemistry

**Jonathan Sweedler**  
Chemistry

**Dale Van Harlingen**  
Physics

**Kenneth Watkin**  
Applied Health Sciences

**Charles Werth**  
Civil and Environmental Engineering

[www.mntl.illinois.edu](http://www.mntl.illinois.edu)

\*Lists current as of January 2009. Updated lists and links to faculty pages can be found on the Web at [mntl.illinois.edu/people](http://mntl.illinois.edu/people).



## Rashid Bashir

*Director*

*Micro and Nanotechnology Laboratory*

*Abel Bliss Professor of Electrical*

*and Computer Engineering and Bioengineering*

### Federally Funded Centers

- Co-Principal Investigator, NIH funded Nanomedicine Development Center: phi29 Packaging Nanomotor for Nanomedicine
- Principal Investigator, Siteman Center of Cancer Nanotechnology Excellence (Illinois co-location)-NCI

### Affiliations

- Department of Electrical and Computer Engineering
- Department of Bioengineering
- Institute for Genomic Biology
- Beckman Institute for Advanced Science and Technology
- Center for Nanoscale Science and Technology (CNST)
- Research Fellow, Shriners' Hospital for Children, Cambridge, Mass., May 2006-present
- Visiting Scientist, Massachusetts General Hospital, Cambridge, Mass., May 2006-present
- Visiting Professor of Surgery, Harvard Medical School, Cambridge, Mass., May 2006-2008

### Education

- PhD, Purdue University, W. Lafayette, Indiana, 1992
- MSEE, Purdue University, W. Lafayette, Indiana, 1989
- BSEE, Texas Tech University, Lubbock, Texas, 1987

### Professional Experience

Rashid Bashir completed his BSEE from Texas Tech University in December 1987. After graduating with his PhD from Purdue University in 1992, he worked at National Semiconductor where he rose to senior engineering manager in the Process Technology Group. He joined Purdue University in October 1998, where he became a professor of Electrical and Computer Engineering and a Courtesy Professor of Biomedical Engineering and Mechanical Engineering. He joined the University of Illinois in October 2007, and leads the Micro and Nanotechnology Laboratory, which houses the largest cleanroom on campus.

### Research Interests

BioMEMS, lab on a chip, bionanotechnology, interfacing biology and engineering from molecular to tissue scale, and applications of semiconductor fabrication to biology.

### Research Description

Bashir's work is focused on developing nanotechnology-based solutions to solve biomedical problems for diagnostics, therapeutics, and tissue engineering. Over his career, Bashir has authored or coauthored more than 150 journal articles, conference papers, and abstracts; has delivered more than 60 invited talks; and has been granted 30 patents.

### Recent Projects

- Microfluidics and nanotechnology for detection of bacterial pathogens
- Silicon based field effect sensors for detection of cancer markers
- Phi29 packaging nanomotors for nanomedicine
- Silicon mass sensors for characterization of living cells

**Global Engagement**

- Presenter, NSF USA-EU Symposium on BioNanotechnology, Ispra, Italy, May 2008
- Member of the United States delegation to Japan for the Second Japan-U.S. (NSF/MEXT) Joint Symposium on Nanotechnology in Advanced Therapy and Diagnostics at Yokohama, Japan, October 9-12, 2003
- "Global Indus Technovator" Award, in Materials and Devices, by the MIT Sloan Business School and the Indian Business Club, Top 20 Technologist South Asian Background, 2003

**Recent Publications**

- K. Park, J. Jang, D. Irimia, J. Sturgis, J. Lee, J. P. Robinson, M. Toner, and R. Bashir, "Living cantilever arrays for characterization of mass of single live cells in fluid," *Lab. Chip*, 2008.
- S. Bhattacharya, S. Salamat, D. Morissette, P. Banada, D. Akin, Y. Liu, A. K. Bhunia, M. Ladisch, and R. Bashir, "PCR based-detection in a micro-fabricated platform," *Lab. Chip*, 8, 1130-1136, 2008.
- D. Akin, J. Sturgis, K. Burkholder, D. Sherman, S. Muhammad, A. Bhunia, J. Paul Robinson, and R. Bashir, "Bacterial mediated delivery of nanoparticles in cells," *Nature Nanotechnology*, 149, 441-449, 2007.
- S. Iqbal, D. Akin, and R. Bashir, "Solid state nanopores with DNA selectivity," *Nature Nanotechnology*, 2, 243-248, 2007.

**Recent Presentations**

- "Bacterial Detection on a Chip." Harvard/MGH CIMIT Summer Education Series, July 16, 2008.
- "Interfacing Silicon and Biology at the Micro and Nanoscale." NSF USA-EU Workshop on Bionanotechnology, Ispra, Italy, May 2008.

**Recent Patents**

- R. Gomez, R. Bashir, A. K. Bhunia, M. Ladisch, J. P. Robinson, U.S. Patent #7,306,924, December 11, 2007. "Biosensor and Related Method."
- R. Bashir, N. Peppas, Z. Hilt, A. Gupta, U.S. Patent #6,935,165, August 30, 2005. "Microscale Sensor Element and Related Device and Method of Manufacture."
- R. Bashir, R. Gomez, M. Ladisch, A. Bhunia, J. P. Robinson, U.S. Patent #6,716, 620, April 6, 2004. "Biosensor and Related Method."
- J. M. McGregor, R. Bashir, W. Yindeepol, U.S. Patent #6,362,064, March 26, 2002. "Elimination of Walkout in High Voltage Trench Isolated Devices."

**Honors**

- Purdue University Faculty Scholar, 2005-2010
- *Small Times* Magazine finalist for "Innovator of the Year" Award, 2005
- NSF Faculty Early Career Award, 2000-2004
- "Education and Mentorship Award," 2003 BioMEMS and Biomedical Nanotechnology World Congress Meeting, Columbus, Ohio

**Professional Society Memberships or Journal Editorships**

- Honorary Member, Golden Key International Honor Society, 2005
- Editorial Board and Section Editor, *Biomedical Microdevices*, Kluwer Academic Press, 2003-present
- Fellow, American Institute of Medical and Biological Engineers (AIMBE), 2009
- Fellow, Institute of Electrical and Electronics Engineers (IEEE), 2009

**Entrepreneurship**

- Co-founder, BioVitesse, Inc., a company aimed at developing chip-based technologies for the detection of bacteria
- Chair, Technical Advisory Board of Dektari, Inc., a startup company focusing on development of chip based solutions for global health applications

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## Ilesanmi Adesida

*Dean*

*College of Engineering*

*Donald Biggar Willett Professor of Engineering*

### **Federally/Campus Funded Centers**

- Director, Center for Nanoscale Science and Technology (CNST)
- Co-Principal Investigator, Siteman Center of Cancer Nanotechnology Excellence (Illinois co-location)-NCI

### **Affiliations**

- Department of Electrical and Computer Engineering
- Department of Materials Science and Engineering
- Coordinated Science Laboratory (CSL)
- Beckman Institute for Advanced Science and Technology
- Center for Nanoscale Science and Technology (CNST)

### **Education**

- PhD, Electrical Engineering, University of California, Berkeley, 1979

### **Professional Experience**

After graduating from the University of California, Berkeley, with a PhD in electrical engineering, Ilesanmi Adesida joined Cornell University in New York, where he rose to visiting assistant professor of Electrical Engineering. He then returned to his native Nigeria to become first an associate professor, then department head of Electrical Engineering. He came to the University of Illinois in 1987 as an assistant professor and is now Dean of the College of Engineering, a role in which he oversees one of the most prestigious engineering schools in the world.

### **Research interests**

Nanofabrication, electronic and transport properties of ultra-low dimensional semiconductor structures; high-speed optoelectronic devices and integrated circuits; and radiation effects.

### **Research Description**

Adesida is head of the Nanoscale Processing and Devices Group at the MNTL, which investigates the processing of semiconductors and other materials at the nanometer scale level and applies these techniques to the realization of ultra-high-speed optoelectronic devices and circuits. Recent thrusts for the nanofabrication work are in the area of biochemical nanotechnologies.

### **Recent Projects**

- Photoelectrochemical etching of n-GaN
- Dry etching techniques (characterization of etch rates, etch profiles, changes in surface stoichiometry and morphology as a function of various etching parameters and gases)
- AlGaIn/GaN HEMTs low noise applications
- Self-aligned AlGaIn/GaN HEMTs

### Recent Publications

- F. M. Mohammed, L. Wang, H. J. Koo, and I. Adesida, "Anatomy-performance correlation in Ti-based contact metallizations on AlGaIn/GaN heterostructures," *Journal of Applied Physics ASAP*, 2007.
- L. Wang W. Zhao, and I. Adesida, "Correlating the Schottky barrier height with the interfacial reactions of Ir gates for InAlAs/InGaAs high electron mobility transistors," *Applied Physics Letters*, 89 (21), 211910, 2006.
- L. Wang, F. M. Mohammed, and I. Adesida, "Differences in the reaction kinetics and contact formation mechanisms of annealed Ti/Al/Mo/Au Ohmic contacts on n-GaN and AlGaIn/GaN epilayers," *Journal Applied Physics ASAP*, 2006.

### Recent Presentations

- IEEE Electron Device Society Distinguished Lecturer, 1997-2002.
- MRS Plenary Talk, 1998.
- IEEE Electron Device Society Distinguished Lecturer, 1997 to present.

### Honors

- President Elect, IEEE Electron Device Society, 2006, 2007
- Best Paper Award, Micro-and NanoEngineering Conference, Europe, 1997
- IBM Postdoctoral Fellowship, 1979-1981

### Professional Society Memberships or Journal Editorships

- Member, National Academy of Engineering, 2006
- Fellow, IEEE, 1998
- Fellow, AAAS, 2003
- Fellow, AVS, 2004
- Fellow, OSA, 2004
- Editor, Papers from the 38th International Symposium on Electron, Ion, and Photo Beams, *Journal of Vacuum Science and Technology*, December 1994

### Entrepreneurship

- Co-founder Xindium, Inc.
- Member, Board of Directors, Fluor Inc.

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## **Irfan Ahmad**

*Associate Director  
Center for Nanoscale Science and Technology  
Research Faculty Agricultural  
and Biological Engineering*

### **Federally Funded Centers**

- Co-Principal Investigator/Project Coordinator, Siteman Center of Cancer Nanotechnology Excellence (Illinois co-location)-NCI

### **Affiliations**

- Department of Agricultural and Biological Engineering
- Center for Nanoscale Science and Technology (CNST)
- Center for South Asian and Middle Eastern Studies (CSAMES)

### **Education**

- PhD, Agricultural Engineering, University of Illinois, 1997
- MS, Agricultural Engineering, University of Illinois, 1992
- BS, University of Agriculture, Faisalabad, Pakistan, 1980

### **Professional Experience**

While in Pakistan (1980-1989), Irfan Ahmad worked as senior scientist/engineer at the Farm Machinery Institute, Pakistan Agricultural Research Council, Islamabad. Prior to that, he served with the International Rice Research Institute of Pakistan, working on the design and development of agricultural machinery and equipment. From 1982 to 1983, he worked as a technical and sales manager for the Sayyed Machinery Limited (SML) in Lahore. During that time, the SML's product reaper-windrower was given the Presidential Award for the best-designed agricultural machine. He also has served as a consultant to the United States Agency for International Development (USAID), the Swiss Development Cooperation, the German Technical Assistance (GTZ), Hagler Bailly, ENERCON, Fiat Trattori, and recently to the Higher Education Commission of Pakistan.

After completing his doctorate and postdoctorate in agricultural and biological engineering at Illinois and the United States Department of Agriculture-funded projects in 2000, he started two startups, Buruj and IT24. He joined the University of Illinois Center for Nanoscale Science and Technology as assistant director in 2002, where he has been engaged in research, initiation and management of multidisciplinary initiatives, projects, and forums, and conducting training and outreach activities.

### **Research Interests**

Bionanotechnology, nanosensors for precision agriculture, nanomedicine, societal implications of nanotechnology, and science and policy.

### **Research Description**

Bionanotechnology research is focused on the design and development of NEMS for plant pathogenesis, evaluating plant extracts for nanomedicine cancer research, and the design and development of sensors for environment-friendly agriculture, and disaster relief. Ahmad has authored or coauthored several journal articles, conference papers, and abstracts, and he has delivered multiple invited talks and media interviews.

### **Recent Projects**

- Center for Cancer Nanotechnology Excellence, NCI
- Nanomedicine for cancer research, United States Agency for International Development, Ministry of Science and Technology/Higher Education Commission of Pakistan
- Biosensors for soybean disease management, C-FAR



**Global Engagement**

- Leading an Earth and Society project at the University of Illinois. "Pakistan Earthquake 2005: Disaster within a Disaster—A Resource for Policy Makers Globally," working with the University of Agriculture, Faisalabad, Pakistan
- Co-lead on the USAID-Ministry of Science and Technology/Higher Education Commission of Pakistan project on Nanomedicine for Cancer Research, with the University of Karachi
- Organizing committee member for the Global Enterprise for Micro-Mechanics and Molecular Medicine (GEM4) Summer School 2009 at Illinois
- Member of College of Engineering, Council for Global Engineering Initiatives
- Organizing committee member for the upcoming international nanotechnology workshops in developing countries

**Recent Publications**

- Y. Wang, A. K. M. Newaz, J. Wu, S. A. Solin, V. R. Kavasseri, N. Jin, I. S. Ahmad, and I. Adesida, "Extraordinary electroconductance in metal-semiconductor hybrid structures," *Applied Physics Letters*, 92(26):262106, 3 pages, 2008.
- I. S. Ahmad and B. T. Cunningham, "Honey I shrunk the world: Research and development in nanotechnology at the University of Illinois," *IEEE Nanotechnology Magazine*, 1(2):5-10. Invited. 2007.
- J. W. Hummel, I. S. Ahmad, S. C. Newman, K. A. Sudduth, and S. Drummond, "Simultaneous soil moisture and cone index measurement." *Trans. ASAE*, 47(3):607-618, 2004.

**Recent Presentations**

- S. George, A. Abbasi, S. Naz, U. Zaman, I. S. Ahmad, K. L. Watkin, L. Chan, H. Fouly, S. Gosangari, J. Drubinskaya, and B. T. Cunningham. "Preliminary Studies on Biologically Active Proteins/Peptides from Medicinal Plants." ASABE Annual International Meeting, Providence, Rhode Island, June 30-July 2, 2008.
- I. S. Ahmad, J. J. Cheng, T. Saif, and H. Fouly. "Nanomedicine for Cancer Therapeutics." Biological Sensorics Conference, Invited. ASABE Annual International Meeting, Minneapolis, June 15-20, 2007.
- I. S. Ahmad. "Nanofabrication Training for Cancer Research." Nanotechnology and Life Sciences Symposium, Saint Louis, March 30, 2007.

**Honors**

- Champaign-Urbana International Humanitarian Award, 2007
- Gamma Sigma Delta and Alpha Epsilon Honor Societies

**Professional Society Memberships or Journal Editorships**

- American Society of Agricultural and Biological Engineers (ASABE)
- American Association for the Advancement of Science (AAAS)
- American Society for Engineering Education (ASEE)
- Reviewer for *ASAE Trans.*, *J. Ag. Engg. UK*, *Plant Disease*, *NIOSH*, *USDA SBIR*, publications

**Entrepreneurship**

- IT24, an information technology company; formerly Senior Vice President/Consultant
- Buruj, a sensors development startup; Founder and President
- NanoSi Advanced Technology Inc.; Advisor/Consultant

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## **K. Y. Norman Cheng**

*Professor*

*Electrical and Computer Engineering*

### **Federally/Campus Funded Centers**

- Director, Hyper-Uniform Nanophotonics Technology Center—a DARPA University Photonics Research Center

### **Affiliations**

- Electrical and Computer Engineering Department

### **Education**

- PhD, EE, Stanford University, 1975
- MSEE Stanford University, 1972
- BSEE Chung-Cheng Institute of Technology, Taiwan, 1969

### **Professional Experience**

K. Y. Norman Cheng joined the University of Illinois Department of Electrical and Computer Engineering faculty in 1987, becoming a full professor in 1995. He served as director of the DARPA University Opto Center for Bio-Optoelectronic Sensor Systems (BOSS) from 2000 to 2004. Before coming to Illinois, he was on faculty at the Chung-Cheng Institute of Technology, Taoyuan, Taiwan, from 1975 to 1979 and 1981 to 1986, and he was on faculty at the National Tsing-Hua University, Hsinchu, Taiwan, in 1987. From 1979 to 1981, he was a member of the technical staff at Bell Laboratories in Murray Hill, New Jersey.

### **Research Interests**

In situ fabrication of low-dimensional optoelectronic materials and devices using soft nanoimprint lithography coupled with MBE growth, novel high-speed optoelectronic devices, next generation III-V-based MOSFETs, and the development of mid-IR optoelectronic devices.

### **Research Description**

Cheng's research is mainly focused in quantum structure materials and devices grown by molecular beam epitaxy (MBE) technology. His research in this area led to the development of rotating substrate holder for uniform MBE growth, the enhancement of electron mobility in modulation doped GaInAs/AlInAs/InP heterostructures, and the first demonstration of GaInAs/AlInAs/InP HEMT. At Illinois, he made contributions to the compound semiconductors, including the first demonstration of dilute nitride III-V-N (GaP<sub>1-x</sub>N<sub>x</sub>) compound semiconductors, the invention of quantum wire heterostructure lasers using discovered strain-induced lateral layer ordering (SILO) process, and demonstration of the world's fastest double heterojunction bipolar transistor (DHBT) ( $f_T \geq 650$ GHz) using GaAsSb/InP type-II heterostructures.

### **Recent Projects**

- DARPA HUNT Center project for developing hyper-uniform nanostructures and high-speed HBTs
- MARCO MSD Center project for developing GaAs-based MOSFET
- ARO MURI project for developing quantum wire IR photodetectors

### Global Engagement

- Collaborating with National Tsing-Hua University in Taiwan on III-V MOSFET development
- Collaborating with the Research Center for Applied Sciences, Academia Sinica on quantum wire IR photodetectors

### Recent Publications

- Z. H. Zhang, K. Y. Cheng, C. F. Xu, and K. C. Hsieh, "Defect-free 100-layer strain-balanced InAs quantum dot structure grown on InP substrate," *Applied Physics Letters*, 89, 063115, 2006.
- C.-L. Tsai, K. Y. Cheng, S.-T. Chou, S.-Y. Lin, "InGaAs quantum wire infrared photodetectors," *Applied Physics Letters*, 91, 181105, 2007.
- W. Snodgrass, B.-R. Wu, K. Y. Cheng, and M. Feng, "Type-II GaAsSb/InP DHBTs with record  $f_T = 670$  GHz and simultaneous  $f_T, f_{MAX} > 400$  GHz," *Proceedings of 2007 International Electron Devices Meeting*, Washington, D.C., December 10-12, 2007.
- K. Meneou and K. Y. Cheng, "Soft photocurable nanoimprint lithography for compound semiconductor nanostructures," *Journal of Vacuum Science Technology*, B 26, 156, 2008.

### Recent Presentations

- K. Y. Cheng and B. R. Wu, "Heteroepitaxy of Antimonides on InP," Invited presentation to the 2007 International Conference on InP and Related Materials (IPRM'07), Matsue, Japan, May 14-18, 2007.
- K. Y. Cheng and Chiun-Lung Tsai, "InGaAs/InP Quantum Wire Infrared Photodetectors," Invited presentation. Proceedings of the 2007 International Electron Devices and Materials Symposium, Hsinchu, Taiwan, November 30-December 1, 2007.

### Recent Patents

- K. C. Hsieh and K. Y. Cheng, U. S. Patent #6,599,564, July 29, 2003. "Substrate independent distributed Bragg reflector and formation method."
- K. C. Hsieh and K. Y. Cheng, U.S. Patent #7,407,863, August 5, 2008. "Adhesive bonding with low temperature grown amorphous."

### Honors

- Fellow, IEEE
- Fellow, American Association for the Advancement of Science
- Molecular Beam Epitaxy Innovator Award, North American MBE Conference, 2007

### Courses Taught

- ECE 440 Solid State Device Electronics
- ECE 488 Compound Semiconductor and Devices

### Professional Society Memberships or Journal Editorships

- Member: IEEE, APS, AVS, and AAAS

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## **Kent Choquette**

*Professor*

*Electrical and Computer Engineering*

### **Affiliations**

- Department of Electrical and Computer Engineering
- Center for Nanoscale Science and Technology (CNST)

### **Education**

- PhD, Materials Science, University of Wisconsin-Madison, 1990
- MS, Materials Science, University of Wisconsin-Madison, 1985
- BS, Engineering Physics, University of Colorado-Boulder, 1984
- BS, Applied Mathematics, University of Colorado-Boulder, 1984

### **Professional Experience**

Kent Choquette began his research career as a research assistant at the University of Wisconsin in 1984. After graduating with his doctorate in 1990, he conducted postdoctoral research at AT&T Bell Laboratories in Murray Hill, New Jersey, and Sandia National Laboratory in Albuquerque. In 1994, he became a principal member of Technical Staff at Sandia. He joined the University of Illinois in 2000 as a professor in the Electrical and Computer Engineering Department. From 2005 to 2007, he served as interim director of the Micro and Nanotechnology Laboratory. He has authored more than 200 technical publications and three book chapters, and has presented numerous invited talks and tutorials.

### **Research Interests**

Vertical cavity surface emitting lasers (VCSELs), micro/nano-cavity lasers, optoelectronic devices, selective oxidation of compound semiconductors, hybrid heterogenous integration, nano-processing fabrication, photonic crystal materials, Si-based optoelectronics and high bandwidth communication systems.

### **Research Description**

Choquette's research group is involved in the study of semiconductor photonic and optoelectronic device physics, fabrication technologies, and systems with a strong emphasis on vertical cavity surface emitting lasers (VCSELs) and photonic crystals. Photonic devices are key components for the infrastructure of the Information Age. Active devices, such as VCSELs, are the foundation for short and medium length optical fiber-based interconnect applications. Photonic crystal nanocavities represent the next generation of photonic technology.

### **Recent Projects**

- Extending the performance of microcavity lasers, such as vertical cavity surface emitting lasers.
- Developing new VCSEL structures, such as composite resonator VCSELs, photonic crystal VCSELs, 2-dimensional coherent VCSEL arrays, micro-fluidic VCSELs, and vertical cavity photonic integrated circuits.
- Establishing new VCSEL applications, such as position sensing with nanometer resolution, 2-dimensional source and receiver arrays for high aggregate rate interconnects, and environmental sensing using micro-fluidic systems.
- Pursuing the next generation of nano-photonic devices, such as photonic crystal nanolasers and waveguides, to enable further optical communication advances.

**Recent Publications**

- A. V. Giannopoulos, C. Long, and K. D. Choquette, "Photonic crystal heterostructure cavity lasers using Kagome lattices," *Electron. Lett.* 44, 803-804, 2008.
- C. Long, K. D. Choquette, M. Levine, and M. Delaney, "Optical characterization of a vertical cavity surface emitting laser source in a coherent population trapping frequency reference," *J. Appl. Phys.*, 103, 033101, ([http://vcsel.micro.uiuc.edu/Pubs/2008\\_JAP\\_Long.pdf](http://vcsel.micro.uiuc.edu/Pubs/2008_JAP_Long.pdf)), 2008.
- A. C. Lehman, D. F. Siriani, and K. D. Choquette, "Two-dimensional electronic beam-steering with implant defined VCSEL arrays," *Elect. Lett.* 43, No. 22, 2007.
- P. O. Leisher, C. Chen, J. D. Sulkin, M. S. B. Alias, K. A. M. Sharif, and K. D. Choquette, "High modulation bandwidth implant-confined photonic crystal vertical cavity surface emitting laser," *IEEE Photon. Tech. Lett.*, 19, 1541-1543, ([http://vcsel.micro.uiuc.edu/Pubs/2007\\_PTL\\_Leisher.pdf](http://vcsel.micro.uiuc.edu/Pubs/2007_PTL_Leisher.pdf)), 2007.
- A. C. Lehman, J. J. Raftery, Jr., P. S. Carney, and K. D. Choquette, "Coherence of photonic crystal vertical cavity surface emitting laser arrays," *IEEE J. Quantum. Electron.* 43, 25-30, 2007.

**Recent Presentations**

- C. Chen, P. O. Leisher, and K. D. Choquette. "High-Speed Single Mode Photonic Crystal VCSEL Design." 2008 Conference of Lasers and Electro Optics, San Jose, CA, May 2008.
- J. D. Sulkin, A. M. Kasten, D. F. Siriani, and K. D. Choquette. "Characterization and Analysis of Micro-Fluidic VCSELs." 2008 Conference of Lasers and Electro Optics, San Jose, CA, May 2008.
- C. Long, W. R. Frei, A. V. Giannopoulos, H. T. Johnson, and K. D. Choquette. "Photonic Crystal Laser Cavities Optimized by the Geometric Projection Method." 2008 Conference of Lasers and Electro Optics, San Jose, CA, May 2008.

**Recent Patents**

- K. D. Choquette and N. Yokuouchi, U. S. Pat. No. 7,085,301. "Photonic Crystal Single Transverse Mode Defect Structure for Vertical Cavity Surface Emitting Laser."
- K. D. Choquette and J. Klem, U. S. Pat. No. 6,931,042, August 16, 2005. "Long Wavelength Vertical Cavity Surface Emitting Laser."
- A. J. Fischer, K. D. Choquette, W. W. Chow, U. S. Pat. No. 6,608,846, August 19, 2003. "Bistable Laser Device with Multiple Coupled Active Vertical-Cavity Resonators."

**Honors**

- Institute of Electrical and Electronic Engineers /LEOS Engineering Achievement Award, 2008
- ECE Sony Faculty Scholar, 2004-2005, 2005-2006, 2006-2007
- Engineering Council Award for Excellence in Advising, 2004, 2005
- IEEE/LEOS Distinguished Lecture Award, 2000-2001, 2001-2002

**Professional Society Memberships or Journal Editorships**

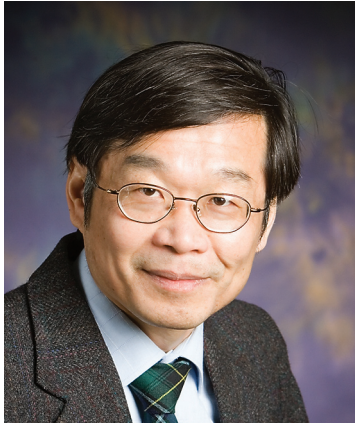
- Fellow, Institute of Electrical and Electronic Engineers, 2003; Optical Society of America, 2004; International Society for Optical Engineering, 2008
- Elected member of the Board of Governors, IEEE Lasers and Electro Optics Society, 2006-2008
- Associate Editor, *IEEE Journal of Quantum Electronics*
- Associate Editor, *IEEE Photonic Technology Letters*
- Guest Editor, *IEEE Journal of Selected Topics in Quantum Electronics*

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## Shun Lien Chuang

*Robert C. MacClinchie Distinguished Professor  
in Electrical and Computer Engineering*

### Federally Funded Center

- Team Member, University Photonics Center (CONSRT) at University of California-Berkeley, DARPA
- Team Member, MURI- Silicon Photonics with Arizona State University, Air Force Office of Scientific Research

### Affiliations

- Department of Electrical and Computer Engineering

### Education

- PhD, Electrical Engineering and Computer Science, MIT, 1983
- Electrical Engineer Degree, Electrical Engineering and Computer Science, MIT, 1981
- MS, Electrical Engineering and Computer Science, MIT, 1980
- BSEE, National Taiwan University, Taipei, 1976

### Professional Experience

Shun Lien Chuang has been with the University of Illinois since he received his PhD in 1983. Over the past several years, he was a visitor as a sabbatical professor or researcher at Bell Laboratories in New Jersey, Sony Research Center, NTT Basic Research Center, Fujitsu Research Laboratories in Japan, NASA Ames Research Center in California, and Cavendish Laboratory at Cambridge University in the United Kingdom.

### Research Interests

Photonics, optoelectronics, semiconductor device physics, semiconductor lasers, nanolasers, surface plasmonics, modulators, photodetectors, quantum electronics, electromagnetics, and fiber optical sensors.

### Research Description

Chuang's group is interested in quantum-dot and quantum-well semiconductor devices for slow light or wavelength conversion, nanolasers using surface plasmonics, superlattice photodetectors, and terahertz quantum-cascade lasers.

### Recent Projects

- Semiconductor optoelectronic device physics: The devices include nanolasers using semiconductor quantum wells and quantum dots with surface plasmonic waveguides; integrated electroabsorption modulator-lasers; new semiconductor materials such as antimony-based type-II quantum-well structures for mid-infrared photodetectors; and GaAs- and GaN-based quantum-cascade lasers.
- Slow and fast light using quantum-well and quantum-dot semiconductor optical amplifiers: Chuang's group has demonstrated slow and fast light at room temperature using coherent population oscillation and four-wave-mixing effects. The slow light devices have potential applications as optical buffers, dispersion compensation devices, as well as microwave photonics.
- High-speed modulation of lasers and wavelength division multiplexing (WDM) research: High-speed microwave modulation of semiconductor lasers and wavelength conversion using quantum-well and quantum-dot devices are investigated. Wavelength conversion for WDM applications using four-wave mixing, cross-gain and cross-absorption modulation are studied.
- Fiber-optic sensors for civil structure applications: The project goal is to design fiber optic sensors for transportation safety such as railroad and highway bridge applications.

### Global Engagement

- Served as a Distinguished Lecturer for IEEE Lasers and Electro-Optics Society (LEOS) from 2004 to 2006.

**Recent Publications**

- S. L. Chuang, *Physics of Photonic Devices*, New York: Wiley, New York, second edition, 2009 (in press); first edition, *Physics of Optoelectronic Devices*, Wiley, 1995.
- J. Kim, P. K. Kondratko, S. L. Chuang, G. Walter, N. Holonyak Jr., R. D. Heller, X. B. Zhang, and R. D. Dupuis, "Tunneling injection quantum-dot lasers with polarization-dependent photon-mediated carrier re-distribution and gain narrowing," *IEEE Journal of Quantum Electronics*, vol. 41, pp. 1369-1379, 2005.
- J. Kim and S. L. Chuang, "Theoretical and experimental study of optical gain, refractive index change, and linewidth enhancement factor of p-doped quantum-dot lasers," *IEEE Journal of Quantum Electronics*, vol. 42, pp. 942-952, 2006.
- P. Kondratko and S. L. Chuang, "Slow-to-fast light using absorption to gain switching in quantum-well semiconductor optical amplifier," *Optic Express*, vol. 15, pp. 9963-9969, 2007.
- S. W. Chang, C. Y. Ni, and S. L. Chuang, "Theory for bowtie plasmonic nanolasers," *Optic Express*, vol. 16, pp. 10580-10595, 2008.

**Recent Presentations**

- S. L. Chuang, "Tunneling Injection Semiconductor Quantum-Dot Laser," Invited keynote speech and IEEE LEOS distinguished lecture, International Workshop on Physics and Applications of Semiconductor Lasers (PHASE), Supelec, Metz, France, March 2005.
- S. L. Chuang, "Slow Light In Semiconductor Quantum Dots And Quantum Wells," Invited, 5th International Conference on Quantum Dots, Gyeongju, Korea, May 11-16, 2008.
- S. L. Chuang, "From Quantum Mechanics To Nanophotonics," Invited keynote speech, Optics and Photonics, Taipei, Taiwan, October 4-6, 2008.

**Patents**

- S. L. Chuang, J. V. Li, and R. Q. Yang, U.S. Patent #7,282,777, October 16, 2007. "Interband Cascade Detectors."

**Honors**

- Humboldt Research Award for Senior U.S. Scientists, 2008-2009
- William Streifer Scientific Achievement Award, IEEE Lasers and Electro-Optics Society (LEOS), 2007
- Distinguished Lecturer Award, IEEE Lasers and Electro-Optics Society (LEOS), 2004-2006
- Engineering Excellence Award, Optical Society of America, 2004
- Faculty Fellow, EPSRC to visit the University of Cambridge, UK
- Fellow, Japan Society for the Promotion of Science to visit the University of Tokyo
- Associate, Center for Advanced Study, University of Illinois, 1995-1996

**Courses Taught at Illinois**

- ECE 452 Electromagnetic Waves and Electro-Optics
- ECE 536 Integrated Optics and Optoelectronics
- ECE 520 Electromagnetic Waves and Radiating Systems
- ECE 329 Introduction to Electromagnetic Fields
- ECE 440 Solid State Electronic Devices
- ECE 450 Lines, Fields, and Waves

**Professional Society Memberships or Journal Editorships**

- Fellow, American Physical Society
- Fellow, IEEE
- Fellow, Optical Society of America
- Associate Editor, *IEEE J. Lightwave Technology*, 2007-present
- Associate Editor, *IEEE J. Quantum Electronics*, 1997-2002
- Guest Editor, *IEEE J. Quantum Electronics*, Mid-IR Quantum-Cascade Lasers, June 2002

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## **James J. Coleman**

*Intel Alumni Endowed Chair in Electrical and Computer Engineering*

### **Federally/Campus Funded Centers**

- Director, Semiconductor Laser Laboratory

### **Affiliations**

- Department of Electrical and Computer Engineering
- Department of Materials Science and Engineering
- Coordinated Science Laboratory (CSL)
- Center for Nanoscale Science and Technology (CNST)

### **Education**

- PhD, Electrical Engineering, University of Illinois at Urbana-Champaign, 1975
- MS, Electrical Engineering, University of Illinois at Urbana-Champaign, 1973
- BS, Electrical Engineering, University of Illinois at Urbana-Champaign, 1972

### **Professional Experience**

Before joining the University of Illinois as an associate professor of engineering in 1982, James J. Coleman worked at Rockwell International in Anaheim, California, where he contributed to the development of the metalorganic chemical vapor deposition (MOCVD) growth method and to the processing and testing of various high speed electronic and photonic devices, such as lasers, avalanche photodetectors, high efficiency heteroface, solar cells and epitaxial Gunn oscillators. Prior to that, he was employed at Bell Laboratories in Murray Hill, New Jersey, where he studied the growth and processing of long wavelength lasers and developed high performance room-temperature cw 1.3  $\mu\text{m}$  lasers for early fiber optic telecommunications systems. His career path was shaped by graduate work at the University of Illinois.

### **Research Interests**

Semiconductor lasers, optoelectronics, epitaxial growth, quantum dots, and nanostructures.

### **Research Description**

Coleman has established a laboratory for the development of III-V semiconductor lasers and photonic devices grown by metalorganic chemical vapor deposition (MOCVD). He and his students are involved in the study of quantum dots, quantum well heterostructures, and low threshold and high power single mode index guided lasers and arrays. Coleman's research is vital to fiber optic telecommunications systems.

### **Recent Projects**

- Metalorganic chemical vapor deposition
- Selective area epitaxy
- Distributed Bragg reflectors and integrated photonics
- High brightness lasers
- Quantum dots and quantum dot selective area epitaxy



**Recent Publications**

- V. C. Elarde and J. J. Coleman, "A novel ordered nanopore array diode laser," *IEEE Photonics Technology Letters*, 20 Issue 4, pp. 240-242, Feb. 15, 2008.
- R. K. Price, V. B. Verma, K. E. Tobin, V. C. Elarde, and J. J. Coleman, "Y-branch surface-etched distributed Bragg reflector lasers at 850 nm for optical heterodyning," *IEEE Photonics Technology Letters*, 19, pp. 1610-1612, 2007.
- V. C. Elarde, and J. J. Coleman, "Nanoscale selective area epitaxy for optoelectronic devices," *Progress in Quantum Electronics*, 31, n 6, p 225-57, 2007.

**Recent Presentations**

- J. J. Coleman, V. C. Elarde, and V. B. Verma. "Patterned Quantum Dot Lasers by Nanoscale Selective Epitaxy." Invited. Integrated Photonics and Nanophotonics Research and Applications (IPNRA), Boston, July 2008.
- V. B. Verma, V. C. Elarde, and J. J. Coleman. "The Ordered Nanopore Array Diode Laser: Comparing Analysis with Experiment." Conference on Lasers and Electro-Optics (CLEO), San Jose, May 2008.
- J. J. Coleman. "Lasers with Nanopatterned Active Regions." Invited. Conference on Lasers and Electro-Optics (CLEO), San Jose, May 2008.

**Recent Patents**

- J. J. Coleman and S. D. Roh, U.S. Patent #7,339,968. "Current Biased Dual DBR Grating Semiconductor Laser."
- J. J. Coleman and M. S. Zediker, Canadian Patent #2,459,313. "Flared and Tapered Rib Waveguide Semiconductor Laser and Method for Making Same."
- J. J. Coleman and S. D. Roh, U.S. Patent #6,728,290. "Current Biased Dual DBR Grating Semiconductor Laser."

**Honors**

- IEEE David Sarnoff Award "for leadership in the development of highly reliable strained-layer lasers," 2008
- IEEE Lasers and Electro-Optics Society Distinguished Service Award, 2008
- Teachers Ranked as Excellent, Spring 2007
- Nick Holonyak, Jr. Award, Optical Society of America "for a career of contributions to quantum well and strained-layer semiconductor lasers through innovative epitaxial growth methods and novel device designs," 2006

**Professional Society Memberships or Journal Editorships**

- Chair, Awards Committee, IEEE Nanotechnology Council, 2008
- Member, IEEE LEOS Distinguished Lecturer Selection Committee, 2008
- Chair, Fellows Committee, IEEE Nanotechnology Council, 2007
- Chair, Fellows Committee, IEEE Nanotechnology Council, 2006
- Vice-President (Publications) IEEE Lasers and Electro-Optics Society, 2004-2006

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## **Brian T. Cunningham**

*Associate Professor*

*Electrical and Computer Engineering*

### **Federally Funded Centers**

- NSF Nano-CEMMS Investigator

### **Affiliations**

- Department of Electrical and Computer Engineering
- Department of Bioengineering
- Department of Material Science and Engineering
- Institute for Genomic Biology
- Center for Nanoscale Science and Technology (CNST)

### **Education**

- PhD, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 1990
- MS, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 1987
- BS, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 1986

### **Professional Experience**

Over the past 20 years, Brian T. Cunningham's research has taken him from the university to the corporate world and back again. After graduating from the University of Illinois with a doctorate in electrical and computer engineering, he pursued postdoctoral work at Sandia National Laboratory, Albuquerque. He left to become senior project scientist in Ratheon's Raytheon Electronic Systems Division in Lexington, Massachusetts, followed by Draper Laboratory in Cambridge, Massachusetts, where he served as group leader for MEMS Sensors, director of Bioengineering Programs, and associate director of the Center for Innovative Minimally Invasive Therapy. He founded SRU Biosystems in Woburn, Massachusetts, and served as chief technical officer in 2000. He returned to Illinois in 2004 as an associate professor and continues to serve on the board of directors and as chief technical scientist of SRU Biosystems.

### **Research Interests**

Nanophotonics, microelectronics, bionanotechnology, nanomaterials, bioMEMS, MioMEMS, NEMS, nanofabrications, optical biosensors, photonic crystals, finite difference time domain analysis, and sensor design and instrumentation.

### **Research Description**

Cunningham's research is focused at the intersection of nanotechnology, biology, electromagnetics, and optics to develop technology that impacts health care, the life sciences, agriculture, and the environment. His group's work is grounded in fundamental principles of electromagnetics, which they use to design devices that interact with light in interesting ways. They also seek to find inexpensive ways to manufacture the technology and have developed plastic-based fabrication methods that can accurately produce nanometer-scale features over large surface areas.

### **Recent Projects**

- Photonic crystal fluorescent enhancement, NSF
- Photonic crystal biosensors for high throughput screening: application to the apoptosis pathway, NIH
- Tunable photonic crystal agile laser eye protection, Army

- Photonic crystal biosensors, SRU Biosystems
- Faculty grant, 3M
- Applications of NanoCEMMS for drug discovery, NSF NanoCEMMS Center

### Global Engagement

- Nanomedicine for cancer research, United States Agency for International Development, Ministry of Science and Technology/Higher Education Commission of Pakistan

### Recent Publications

- N. Ganesh, W. Zhang, P. C. Mathias, and B. T. Cunningham, "Enhanced fluorescence emission from quantum dots on a photonic crystal surface," *Nature Nanotechnology*, v 2, no 8, p. 515-520, 2007.
- G. J. Slavik, G. Ragetyl, N. Ganesh, D. J. Griffon, and B. T. Cunningham, "A replica molding technique for producing fibrous Chitosan scaffolds for cartilage engineering," *Journal of Materials Chemistry*, vol. 17, p. 4095-4101, 2007.
- L. L. Chan, M. F. Pineda, J. Heeres, P. Hergenrother, and B. T. Cunningham, "General method for discovering inhibitors of protein-DNA interactions using photonic crystal biosensors," *ACS Chemical Biology*, In Press, July 2008.

### Recent Presentations

- "Optical Resonators for Label-Free Detection: Photonic Crystals, Microrings, and Lasers," SBS Symposium on Label-Free Technologies in Drug Discovery, Dresden, Germany, June 2008.
- C. J. Choi, and B. T. Cunningham. "Photonic Crystal Optofluidics for High Throughput Biosensing." Conference on Lasers and Electro Optics, San Jose, California, May 2008.
- "Photonic Crystal Biosensors for Label-Free Detection and Fluorescence Enhancement." Gordon Research Conference in Bioanalytical Sensors, Providence, Rhode Island, June 2008.

### Recent Patents

- B. T. Cunningham, J. Pepper, B. Lin, P. Li, J. Qiu, H. Pien, U.S. Patent #7,371,562. "Guided Mode Resonant Filter Biosensor Using a Linear Grating Surface Structure."
- B. Lin, J. Pepper, B. T. Cunningham, J. Gerstenmaier, P. Li, J. Qiu, and H. Pien, U.S. Patent #7,312,090. "Label-Free Methods for Performing Assays Using a Colorimetric Resonant Reflectance Optical Biosensor."
- C. Baird, B. T. Cunningham, P. Li, U.S. Patent #7,309,614. "Self-Referencing Biodetection Method and Patterned Bioassays."

### Honors

- Xerox Award for Faculty Research, 2008
- 3M Nontenured Faculty Grant, 2007
- Senior Member, IEEE, 2007
- Draper Laboratory Best Patent Award, "Flexural Plate Wave Sensor and Array," 2006

### Professional Society Memberships or Journal Editorships

- Senior Member, IEEE, 2007
- Executive Committee Member of IEEE Sensors Council
- IEEE, MRS, SBS

### Entrepreneurship

- SRU Biosystems (Woburn, Massachusetts), a universal assay system that enables label-free detection of drug-target interactions

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## Milton Feng

*Nick Holonyak Chair Professor of Electrical and Computer Engineering*

### Federally Funded Centers

- Deputy Director, DARPA Center of Hyper-Uniform NanoPhotonic Technologies (HUNT) for Ultra-Fast Optoelectric Systems (HUNT, \$6.5 million) (2004-2008)
- Deputy Director, DARPA University Photonics Center, Bio Optoelectronics System (BOSS, \$5.5 million) (2001-2005)
- Co-Principal Investigator, III-V MOSFET (SRC MARCO MIT MSD Center) (2007-2010)

### Affiliations

Department of Electrical and Computer Engineering  
Coordinated Science Laboratory (CSL)  
Center for Nanoscale Science and Technology (CNST)

### Education

PhD, Electrical Engineering, University of Illinois at Urbana-Champaign , 1979

### Professional Experience

Milton Feng began his career in 1979 at Hughes Aircraft Company, where he was head of GaAs Material and Device at the Torrance Research Center. While there, he made major contributions on super low noise and power ion implanted GaAs MESFET monolithic microwave integrated circuits for phased array radar and in 1983, demonstrated the first 60 GHz amplifier.

In 1984, he joined Ford Electronics Inc. as director of Advanced Development and GaAs Fab Operation. His many accomplishments in that position included building the world's largest GaAs operation for commercial and military products, as well as creating the first GaAs 1K SRAM for commercial applications. He joined the University of Illinois faculty in 2000.

### Research Interests

High speed microelectronics devices and ICs for wireless and optoelectronics: optoelectronic IC; monolithic microwave and millimeter-wave IC; digital IC; RF-MEMS for wireless communications; advanced Si-CMOS device physics; advanced SiGe HBT Ics; light emitting transistor; transistor laser; III-V MOSFET; THz device and IC technology.

### Research Description

In 2003, Milton Feng created the world's fastest transistor. (Faster transistors translate into faster computers, more flexible and secure wireless communications systems, and more effective combat systems). A few years later, he and his graduate students broke their own world record with a device that was approximately 300 gigahertz faster than other transistors of the time.

But perhaps Feng's most notable scientific achievement to date is his collaboration with Nick Holonyak, Jr., on the first practical light-emitting transistor, called Transistor Laser, which has a three-port operation including an electrical input with an electrical output and optical output. Feng's research has opened up a new frontier in optoelectronics integration as well as fast laser modulation, switching, and signal processing.

Feng leads the High Speed Device and IC group, aimed at "major breakthrough" devices and integrated IC and antenna technology toward THz operation.

**Recent Projects**

- Principal Investigator, technology for frequency agile direct digital synthesizer (DARPA-TFAST, BAE System \$2.1 million), 2003-2009
- Principal Investigator, THz HBT transistors (DARPA-Navy SPAWAR \$1.2 million), 2005-2009
- Principal Investigator, sub-millimeter wave imaging (DARPA-SWIFT-Army ARL), 2005-2008

**Global Engagement**

- Board of Directors, Supertex Inc. (NASDAQ), 2001 to present
- Advisor, Taiwan Chung Yuan Christian University, 2005-2007

**Recent Publications**

- W. Snodgrass, W. Hafez, N. Harff, and M. Feng, "Pseudomorphic InP/InGaAs HBTs (PHBTs) experimentally demonstrated  $f_t = 765$  Ghz at 25C increasing to  $f_t = 845$  GHz at -55C," *IEDM (World Fastest Transistor)*, 2006.
- N. Holonyak, Jr. and M. Feng, "The transistor laser," *IEEE Spectrum*, vol. 43 (#2), 50-55, Feb. 2006.
- M. Feng, N. Holonyak, Jr., G. Walter, and R. Chan, "Room temperature continuous wave operation of a heterojunction bipolar laser," *Applied Physics Letters*, vol. 87, pp. 131103, (Cover Page APL), 2005.

**Recent Presentations**

- "From THz HBT to Vertical III-V MOSFET." Invited, Taiwan Nano Symposium and Taiwan Semiconductor Microelectronics Corp. (TSMC), 2008.
- "From Bardeen Transistor to Transistor Laser." Invited, Taiwan Academy Sinica and National Chao Tung University, 2008.
- "Scalable High Frequency Noise in Si Nanoscale CMOS." Invited, United Microelectronics Corp, 2008.
- "Transistor Laser for Optical Interconnect." Invited, Georgia Tech, IBM and Intel, 2008.
- "Toward THz Transistor." Invited, GOMAC Conference, 2008, and DARPA TECH, 2007.

**Patents**

- 15 U.S. patents awarded in GaAs on silicon, RF MEM switch, high speed HBTs and transistor lasers

**Honors**

- American Institute of Physics selected "Room Temperature CW Operation of Transistor Laser" as top 5 papers published in the 43 years history of *Applied Physics Letter*, 2006
- *Discover* Magazine selected Transistor Laser as top 100 most important discoveries, 2005
- Dr. Pan Wen Yuan Award, 2000
- IEEE David Sarnoff Award, 1997

**Professional Society Memberships or Journal Editorships**

- Fellow, IEEE, 1992
- Fellow, Optical Society of America (OSA), 2003

**Entrepreneurship**

- Founder and Member, Board of Directors, Quantum Electronics Optical System, 2008 to present
- Founder and Member, Board of Directors, Xindium Technology Inc., 2001-2004

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**Matthew Gilbert**  
*Assistant Professor*  
*Electrical and Computer Engineering*

#### **Affiliations**

- Department of Electrical and Computer Engineering
- Beckman Institute for Advanced Science and Technology

#### **Education**

- PhD, Arizona State University, Tempe, Arizona, 2005
- MSEE, Arizona State University, Tempe, Arizona, 2003
- BSEE, Arizona State University, Tempe, Arizona, 2000

#### **Professional Experience**

Matthew Gilbert completed his BSEE from Arizona State University in May 2000. After graduating with his PhD from Arizona State University in 2005, he worked as a postdoctoral fellow with Allan MacDonald at the University of Texas at Austin. In 2006, he became the assistant director of the South West Academy of Nanoelectronics (SWAN) at the University of Texas at Austin. He joined the University of Illinois in June 2008, where he is now an assistant professor of Electrical and Computer Engineering.

#### **Research Interests**

Semiclassical and quantum transport theory of many-electron systems in nanostructures, reduced dimensionality systems, and strong external fields. The development of post-CMOS logic devices to replace CMOS functionality.

#### **Research Description**

Gilbert's research focuses on emergent semiconductor nanodevice technology that exploits computational state variables beyond that of charge (e.g. spin and phase) and their application to form beyond CMOS architectures. He has published more than 40 conference and journal papers in the areas of spintronics, semiconductor nanowire MOS devices, graphene, computational algorithms for efficient transport calculation and correlated many-body systems and theory.

#### **Recent Projects**

- Post-CMOS logic
- Path integral formulation of linear response theory
- Correlated effects in bilayer heterojunctions
- Graphene based nanophotonics

### **Recent Publications**

- L. Zhang, M. J. Gilbert, J. Pedersen, and J. Shumway, "Path integral study of the role of correlation in exchange coupling of spins in double quantum dots and optical lattices," ArXiv: 0809-0038, 2008.
- D. Basu, M. J. Gilbert, L. F. Register, A. H. MacDonald, and S. K. Banerjee, "Effect of edge roughness on electronic transport in graphene nanoribbon channel metal-oxide-semiconductor field-effect transistors," *Applied Physics Letters*, 92, 042114, 2008.
- M. J. Gilbert and S. K. Banerjee, "Ballistic to diffusive crossover in III-V nanowire transistors," *IEEE Transactions on Electron Devices*, 54, 645 (2007).
- M. J. Gilbert, R. Akis, and D. K. Ferry, "Phonon assisted ballistic to diffusive crossover in silicon nanowire transistors," *Journal of Applied Physics*, 98(9), 94303, 2005.

### **Professional Society Memberships or Journal Editorships**

- Member, Golden Key National Honor Society
- Member, Eta Kappa Nu
- Member, Tau Beta Pi

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## Lynford L. Goddard

Assistant Professor  
Electrical and Computer Engineering

### Affiliations

- Department of Electrical and Computer Engineering
- Center for Nanoscale Science and Technology (CNST)

### Education

- PhD, Physics, minor in Math, Stanford University, Stanford, California, 2005

### Professional Experience

Lynford L. Goddard began his undergraduate research career at the Stanford Linear Accelerator Center in California. He subsequently completed internships at Stanford University, the Georgia Institute of Technology, JFE Steel Corporation (formerly NKK), IBM Almaden Research Center, and Xerox Palo Alto Research Center. While working on his doctorate at Stanford, Goddard was a graduate research assistant investigating the intrinsic properties of novel 1.2-1.6 GaInNAs(Sb)/GaAs laser diodes. After graduating, he spent two years as a postdoctoral researcher at Lawrence Livermore National Laboratory, before coming to Illinois.

### Research Interests

Optoelectronics; photonics-based sensors; all-optical data processing systems; photonic integrated circuits; semiconductor lasers, modulators, and detectors; low loss semiconductor/dielectric waveguides and interconnects; and semiconductor band structure modeling.

### Research Description

The Photonics Systems Laboratory builds high-speed chip-scale monolithic photonic systems. The team integrates laser sources with all-optical sensors, transducers, switches, interconnects, and logic and memory elements on the same platform in order to enable multipurpose adaptive photonic systems. These systems will be field programmable and will have the capability of making decisions based on measured data and received instructions. The research effort will encompass: device design and modeling, materials research and characterization of novel semiconductor materials, processing techniques and device fabrication, and device characterization and model validation.

### Recent Projects

- Fabrication of reconfigurable all optical universal logic gates
- Ellipsometry measurements of Pd and Pt surface coatings

### Recent Publications

- L. Goddard, J. Kallman, and T. Bond, "Rapidly reconfigurable all-optical universal logic gates," Invited. *Proc. SPIE* 6368, pp. 63680H-1-13, Oct. 2006.
- L. Goddard, S. Bank, M. Wistey, H. Yuen, Z. Rao, and J. S. Harris Jr., "Recombination, gain, band structure, efficiency, and reliability of 1.5 micron GaInNAsSb/GaAs lasers," *Journal of Applied Physics*, 97, pp. 083101-1-15, April 2005.
- L. Goddard, S. Bank, M. Wistey, H. Yuen, and J. S. Harris Jr., "High performance GaInNAsSb/GaAs lasers at 1.5 micron," Invited. *Proc. SPIE* 5738, pp. 180-191, April 2005.



### Recent Presentations

- L. Goddard, T. Bond, G. Cole, and E. Behymer. "Functionalized Lateral Surface Coated Lasers for Chem.-Bio Detection." 2007 IEEE Sensors Conference, Atlanta, pp. 1181-1184, Oct. 2007.
- L. Goddard, S. Bank, M. Wistey, H. Yuen, H. Bae, and J. S. Harris, Jr. "High Power 1.5 $\mu$ m GaInNAsSb/GaAs Lasers." Invited. IEEE LEOS Workshop on Semiconductor Lasers, Baltimore, May 2005.
- L. Goddard, S. Bank, M. Wistey, H. Yuen, H. Bae, and J. S. Harris, "Differential Gain and Non-linear Gain Compression of GaInNAsSb/GaAs Lasers at 1.5  $\mu$ m." 24th Conference on Lasers and Electro Optics (CLEO), Baltimore, Session CMF1, pp. 86-88, May 2005.

### Recent Patents

- Patent Pending, 2008. "Low Loss, High and Low Index Contrast Waveguides in Semiconductors."
- Patent Pending, 2007. "Rapidly Reconfigurable All-Optical Universal Logic Gates."
- Provisional Patent, 2007. "Tunable Photonic Cavities for *in-situ* Spectroscopic Trace Gas Detection."

### Honors

- National Physical Science Consortium Scholar, 1998-2004
- Phi Beta Kappa Award, 1996
- National Society of Black Engineers Fellow, 1994
- Paul H. Kirkpatrick Award, Excellence in Teaching of Physics, 2003

### Professional Society Memberships or Journal Editorships

- IEEE
- SPIE
- OSA

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## **Nick Holonyak, Jr.**

*John Bardeen Endowed Chair in Electrical and Computer Engineering and Physics*

### **Federally Funded Centers**

- DARPA Center of Hyper-Uniform NanoPhotonic Technologies (HUNT) for Ultra-Fast Optoelectric Systems

### **Affiliations**

- Department of Electrical and Computer Engineering
- Department of Physics
- Center for Advanced Study

### **Education**

- PhD, Electrical Engineering, University of Illinois at Urbana-Champaign, 1954

### **Professional Experience**

Professor Nick Holonyak, Jr., has worked at the forefront of semiconductor science and technology since 1952. At Bell Labs, he was an early contributor to diffused-impurity oxide-masked silicon device technology. Later at General Electric, he was the inventor of the shorted emitter used in all thyristors and fundamental to all symmetrical switches, including the basic element in the wall light dimmer. Also, he was the first to make silicon tunnel diodes and observe phonon-assisted tunneling. He invented closed-tube vapor phase epitaxy of III-V semiconductors, which is the forerunner of all present-day III-V epitaxy. He was the first to grow  $\text{GaAs}_{1-x}\text{P}_x$  (an alloy) and in 1962, was the first to construct a visible-spectrum semiconductor laser. For this work, he is considered the inventor of the first practical LED, the red  $\text{GaAs}_{1-x}\text{P}_x$  LED.

He joined the Illinois faculty in 1963, and has since pioneered the study of quantum-well (QW) and superlattice (SL) lasers. His lab was the first to construct p-n quantum well lasers (InP-InGaAsP, LPE), and to achieve continuous-wave room-temperature laser operation of quantum-well heterostructures and superlattices.

In 1980, his research group discovered impurity-induced layer disordering. In 1990, he and his students introduced higher temperature (>400 C) stable native oxides on Al-bearing III-V compounds and have demonstrated their use in lasers and LEDs. In addition, they were the first to demonstrate lateral oxidation of  $\text{Al}_{1-x}\text{Ga}_x\text{As}$  for current confinement in a semiconductor laser. In 1997, they were the first to demonstrate the use of tunnel junction for lateral current conduction in vertical cavity surface emitting lasers.

### **Research Interests**

Semiconductors, semiconductor device physics, semiconductor crystal growth and junction formation, diffused Si devices, SCRs, TRIACs, double injection, luminescence, light emitting diodes (LEDs), heterojunctions, lasers, tunnel diodes, compound semiconductors, quantum well heterostructures, superlattices, quantum well lasers, impurity-induced layer disordering, Al-based III-V native oxides and their use in heterostructures devices.

### **Global Engagement**

- Foreign Member of the Russian Academy of Sciences, 1999

**Recent Publications**

- J. J. Wierer, P. W. Evans, D. A. Kellogg, and N. Holonyak, Jr., "Lateral electron current operation of vertical surface emitting lasers with buried tunnel contact hole sources," *Applied Physics Letters*, vol. 72, pp. 2742-2744, 1997.
- S. A. Maranowski, A. R. Sugg, E. I. Chen, and N. Holonyak, Jr., "Native oxide top- and bottom-confined narrow stripe p-n  $\text{Al}_x\text{Ga}_{1-y}\text{As}-\text{GaAs}-\text{In}_x\text{Ga}_{1-x}\text{As}$  quantum well heterostructure laser," *Applied Physics Letters*, vol. 63, pp. 1660-1662, 1993.
- J. M. Dallesasse, N. Holonyak, Jr. A. R. Sugg, T. A. Richard, and N. El-Zein, "Hydrolyzation oxidation of  $\text{Al}_x\text{Ga}_{1-x}\text{As}-\text{AlAs}-\text{GaAs}$  quantum well heterostructures and superlattices," *Applied Physics Letters*, vol. 57, pp. 2844-2846, 1990.

**Patents**

- More than 50 patents awarded

**Honors**

- National Inventors Hall of Fame, 2008
- Member of the Consumer Electronics Association (CEA) Hall of Fame, 2006
- Laureate of the Lincoln Academy of Illinois, 2005
- Izaak Walton League of America Illinois Division Energy Conservation Award, 2004
- Lelmelson-MIT Prize, 2004
- National Medal of Technology; National Medal of Science

**Professional Society Memberships or Journal Editorships**

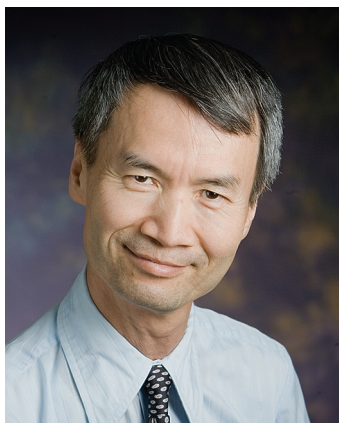
- Fellow, IEEE
- Fellow, Eta Kappa Nu
- Fellow, Russian Academy of Sciences
- Fellow, American Association Advancement Science
- Fellow, U.S. National Academy of Sciences
- Fellow, U.S. National Academy of Engineering

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## **Kuang-Chien Hsieh**

*Professor*

*Electrical and Computer Engineering*

### **Federally/Campus Funded Centers**

- Center of Hyper-Uniform Nano-Photonic Technologies for Ultra-fast Optoelectronic Systems, funded by DARPA/MTO

### **Affiliations**

- Department of Materials Science and Engineering

### **Education**

- PhD, Metallurgical Engineering University of Illinois, October 1982

### **Professional Experience**

- Associate Professor, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 1993
- Visiting Professor, National Nano Device Laboratory, Taiwan, 1996
- Professor, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 2000

### **Research Interests**

Semiconductor materials/devices processing and characterization.

### **Research Description**

Kuang-Chien Hsieh's research is focused on long-range ordering and strain induced compositional modulation. Study of the long-range ordering of GaInP and modulation growth of InP and GaP sub-nano layers led to the discovery of self-assembled quantum wire heterostructures to be used as lasers and photodetectors. Another focus of research is low-temperature grown amorphous or polycrystalline (Al, Ga, In)As. Study of low-temperature growth of III-V compounds led to the development of substrate-independent distributed Bragg reflectors to be used in surface emitting LED/lasers, alleviating the lattice-matching constraint in epitaxy. Wet oxidation of the Al-bearing layer further enhances the index difference and improves the reflection efficiency for the Bragg reflectors.

### **Recent Projects**

- Center of Hyper-Uniform Nano-Photonic Technologies for Ultra-fast Optoelectronic Systems, funded by DARPA/MTO
- Center for Bio-Optical Sensing System, funded by DARPA
- Fundamental research on infrared photodetectors, funded by MURI/ARO
- High quantum efficiency infrared photodetector arrays based on nanowire heterostructures, funded by NRO
- Antimonide-based multiple spectra IR imaging arrays grown on GaAs by compliant epitaxy, funded by DARPA/AFOSR

**Recent Publications**

- C. Liao, B.-R. Wu, K.-C. Hsieh, and K. Y. Cheng, "High electron mobility InAs<sub>0.8</sub>Sb<sub>0.2</sub> grown on InP substrates by gas source molecular beam epitaxy," *Journal of Vacuum Science and Technology*, B26, 1078, 2008.
- C. L. Tsai, K. Y. Cheng, S. T. Chou, S. Y. Lin, C. Xu, and K.-C. Hsieh, "Tailoring detection wavelength of InGaAs quantum wire infrared photodetector," *Journal of Vacuum Science and Technology*, B 26, 1140, 2008.
- B.-R. Wu, K. Y. Cheng, C. Xu, and K.-C. Hsieh, "Formation and property of InSb self-assembled quantum dots on GaAsSb lattice matched to InP," *Journal of Vacuum Science and Technology*, B24,1660, 2006.
- C.-L. Tsai, C. Xu, K.-C. Hsieh, and K. Y. Cheng, "Growth optimization of InGaAs quantum wires for infrared photodetector applications," *Journal of Vacuum Science and Technology*, B24, 1527, 2006.
- Z. H. Zhang, K. Y. Cheng, C. F. Xu, and K.-C. Hsieh, "Defect-free 100-layer strain-balanced InAs quantum dots structure grown on InP substrate," *Applied Physics Letters*, 89, 063115, 2006.

**Recent Patents**

- U.S. Patent 7,027,225. "Substrate Independent Distributed Bragg Reflector and Formation Method."
- U.S. Patent 7,407,863. "Adhesive Bonding with Low Temperature Grown Amorphous or Polycrystalline Compound Semiconductors."

**Honors**

- Accenture Outstanding Student and Faculty Award, 2001, 2002, 2003

**Courses Taught**

- Solid State Electronic Devices
- Introduction to Quantum Electronics
- Elements of Engineering Electromagnetics

**Professional Society Memberships or Journal Editorships**

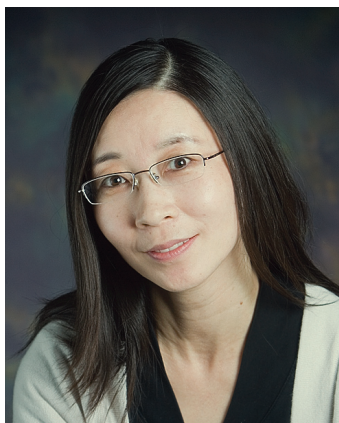
- IEEE
- Materials Research Society
- American Physical Society

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**Xiuling Li**  
*Assistant Professor*  
*Electrical and Computer Engineering*

#### **Federally/Campus Funded Centers**

- Nanostructured Semiconductor Materials and Devices Group

#### **Affiliations**

- Department of Electrical and Computer Engineering
- Beckman Institute for Advanced Science and Technology
- Center for Nanoscale Science and Technology (CNST)

#### **Education**

- PhD, Physical Chemistry, University of California, Los Angeles, 1993
- BS, Physical Chemistry, Peking University, Beijing, 1986

#### **Professional Experience**

After graduating from the University of California, Los Angeles, Xiuling Li conducted postdoctoral research at the California Institute of Technology and the University of Illinois. She later joined the Department of Chemistry as a research assistant professor before leaving for a start-up company EpiWorks, Inc. in Champaign, where she rose to R&D manager. In 2007, she returned to the University of Illinois as an assistant professor in the Department of Electrical and Computer Engineering. She is also a faculty affiliate with the Beckman Institute for Advanced Science and Technology and the Department of Materials Science and Engineering.

#### **Research interests**

Metalorganic chemical vapor deposition (MOCVD), selective area epitaxy, semiconductor nanostructure growth and fabrication, and semiconductor nanoelectronics and optoelectronic devices.

#### **Research Description**

The Nanostructured Semiconductor Materials and Devices Group is focused on advancing semiconductor materials and devices. Li's research has applications in the areas of physical electronics.

#### **Recent Projects**

- Growth and fabrication of GaAs, InP, and GaN-based III-V compound semiconductor three dimensional structures at the nanometer scale, and the realization of 3D semiconductor optoelectronic devices for potential applications in chemical and biological sensing
- Development of high efficiency GaAs-based THz photomixer and the on-chip integration with heterodyned tunable lasers and waveguide
- III-V semiconductor nanowire formation and applications toward nanoinjection lasers and nanoelectronics
- Porous semiconductor nanoscale patterning and applications in integrated circuits and optoelectronics

**Recent Publications**

- X. Li, "Strain induced semiconductor nanotubes and related 3D architectures: from formation process to device applications," *Journal of Physics D*, Invited topical review, in press.
- I. S. Chun and X. Li, "Controlled assembly and dispersion of strain induced InGaAs-GaAs nanotubes," *IEEE Transactions on Nanotechnology*, 7, 493, 2008.
- I. S. Chun, E. K. Chow, and X. Li, "Nanoscale three dimensional pattern formation in light emitting porous silicon," *Applied Physics Letters*, 92, 191113, 2008.
- I. S. Chun, V. B. Verma, and X. Li, "Engineered large area fabrication of ordered InGaAs-GaAs nanotube arrays," *Materials Research Society Symposium Proceedings*, 1057, 1105-40, 2008.
- I. S. Chun, V. B. Verma, V. C. Elarde, S. W. Kim, J. M. Zuo, J. J. Coleman, and X. Li, "InGaAs/GaAs 3D architecture formation by strain induced self-rolling with lithographically defined rectangular stripe arrays," *Journal of Crystal Growth*, 310, 2353, 2008.

**Recent Presentations**

- I. S. Chun, E. K. Chow, and X. Li. "3-D Nanoscale Pattern Formation in Porous Silicon." CLEO/QELS, oral presentation, 2008.
- S. A. Fortuna, X. Zeng, and X. Li. "Self-Aligned Planar GaAs Nanowires Grown by MOCVD on GaAs (100) Substrates." CLEO/QELS, oral presentation, 2008.
- "III-V Semiconductor Nanotubes and Nanowires." University of California, Los Angeles, departmental seminar, 2008.
- "III-V Semiconductor Nanotubes and Planar Nanowires." University of Wisconsin, Madison, departmental seminar, 2008.

**Recent Patents**

- U.S. Patent #61/048,207, pending. "Method of Controlled Growth and Release of Self-Aligned Planar Semiconductor Nanowires."
- U.S. Patent #06,790,785. "Metal-Assisted Chemical Etching Porous Silicon Formation Method."
- U.S. Patent #06,762,134. "Metal-Assisted Chemical Etching to Produce Porous Group III-V Materials."

**Honors**

- National Science Foundation CAREER Award, 2008
- NSF Career Advancement Award for Women Scientists and Engineers, 1997-1998
- Product Research Corporation Prize, UCLA, 1990

**Professional Society Memberships or Journal Editorships**

- IEEE, member
- Materials Research Society, member

**Entrepreneurship**

- R&D manager for start-up company EpiWorks in Champaign

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**Logan Liu**  
*Assistant Professor*  
*Electrical and Computer Engineering*

#### **Affiliations**

- Department of Electrical and Computer Engineering
- Micro and Nanotechnology Laboratory
- Center for Nanoscale Science and Technology (CNST)

#### **Education and Training**

- Lawrence Fellow, Lawrence Livermore National Laboratory, 2008
- Postdoctoral Scholar, UCSF Cancer Center, 2007
- PhD, Bioengineering, University of California-Berkeley, California, 2006
- MS, Bioengineering, University of Toledo, Ohio, 2002
- BEng, Biomedical Engineering, Huazhong University of Science and Technology, Wuhan, China, 2000

#### **Research Interests**

- Nanobiotechnology, micro and nano integrated biochips.

#### **Research Description**

Logan Liu's research focus is on developing molecular imaging and manipulation probes by combining chemical/biological synthesis and physical nanofabrication techniques.

#### **Recent Publications**

- G. L. Liu, J. Kim, Y. Lu, and L. P. Lee, "Optofluidic control via photothermal nanoparticles," *Nature Materials*, 5, 27-32, 2006.
- G. L. Liu, Y. Lu, J. Kim, J. C. Doll, and L. P. Lee, "Magnetic nanocrescents as controllable surface enhanced Raman scattering nanoprobe for biomolecular imaging," *Advanced Materials*, 17, 2683-2699, 2005.
- G. L. Liu, Y. Yin, S. Kunchakarra, B. Mukherjee, D. Gerion, S. D. Jett, D. G. Bear, J. W. Gray, A. P. Alivisatos, L. P. Lee, and F. F. Chen, "A nanoplasmonic molecular ruler for measuring nuclease activity and DNA footprinting," *Nature Nanotechnology* 1, 47-53, 2007.
- G. L. Liu, Y.-T. Long, Y. Choi, T. Kang, and L. P. Lee, "Quantized plasmon quenching dips nanospectroscopy via plasmon resonance energy transfer," *Nature Methods* 4, 1015-1017 (2007).

#### **Presentations**

- G. L. Liu. "Integration of Nanobiosensor in Microfluidic Devices." DARPA MEMS/NEMS and MF3 Program Kick-off Meeting, Minneapolis, Minnesota, October 26, 2006.
- G. L. Liu. "Integrated Nanophotonic Probes and Sensors in Microfluidic Biochip for Functional Genomic Proteomic and Cellomic Studies." Second International Conference on Bio-Nano-Info Fusion and International Forum of Biochip Technology, Beijing, China, October 12, 2006.
- G. L. Liu. "All-optical Microfluidic Circuit for Biochemical and Cellular Analysis Powered by Photoactive Nanoparticles." SPIE Optical & Photonics Annual Meeting, San Diego, California, August 16, 2006.
- G. L. Liu. "Peptide-Nanoparticle Hybrid SERS Sensor for Activity Detections of Prostate Specific Antigen." *Proceedings of 28th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, IEEE EMBC 2006*, New York, August 31, 2006.



### **Honors**

- Ernest O. Lawrence Fellowship, LLNL, U.S. Department of Energy, 2007
- Outstanding Publication Award, Department of Bioengineering, University of California-Berkeley, 2006
- Innovator Award Finalist, International Association of Laboratory Automation, 2006
- Poster Competition Award, 4th UC Surface Sciences Symposium, 2005
- Elected Member, Sigma Xi, 2005
- Berkeley Technology Breakthrough Competition Finalist, 2005
- Conference Session Chair, Photonics West Biomedical Optics, SPIE, 2005
- Berkeley-Stanford Technology Competition Winner, 2003
- Senior Software Engineer Award, Chinese Ministry of Science and Technology, 1999

### **Professional Memberships**

- Member, Optical Society of America, 2004-present
- Member, Association of Laboratory Automation, 2005-present
- Member, American Association for the Advancement of Science, 2005-present

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**Eric Pop**  
*Assistant Professor*  
*Electrical and Computer Engineering*

#### **Federally/Campus Funded Projects**

- “Femto-Joule Atomic-Scale Reversible Switch,” DARPA Young Faculty Award (YFA), July 2008–Dec. 2009
- “Electrohydrodynamic Printing of Conducting Inks and the Effects of Thermal Stress on Carbon, Nanotube Arrays,” NASA Kennedy Space Center, April 2008–March 2009

#### **Affiliations**

- Department of Electrical and Computer Engineering
- Beckman Institute for Advanced Science and Technology

#### **Education**

- PhD, Electrical Engineering, Stanford University, 2005
- MEng, Electrical Engineering, Massachusetts Institute of Technology, 1999
- BS, Electrical Engineering and Physics, Massachusetts Institute of Technology, 1999

#### **Professional Experience**

Eric Pop joined the Department of Electrical and Computer Engineering at the University of Illinois in March 2007. Previously, he was a senior engineer at Intel Corp. and a visiting researcher at Stanford University. He also conducted postdoctoral research at Stanford, where he graduated with a doctorate in electrical engineering. Earlier in his career, he was a graduate research assistant at Stanford, at MIT and IBM Corp. through a co-op program.

#### **Research Interests**

Power and thermal challenges in nanoscale integrated circuits, carbon nanotubes, and graphene for electronic and thermal applications, and alternative solid-state memory devices, e.g. based on phase-change materials.

#### **Research Description**

The PopLab is broadly motivated by power dissipation challenges in integrated circuits. The group takes a “bottom-up” approach to this issue, looking at electrical and thermal transport in nanometer-scale devices, interconnects, and nanoscale material interfaces. The group’s research is both computational and experimental, benefiting from the nanotube CVD system, cleanroom, and characterization facilities in the Micro and Nanotechnology Laboratory (MNLT), in-house modeling codes, and collaborations with Beckman Institute computational groups.

#### **Recent Projects**

- SOS: a nanotube-based configurable logic fabric
- Modeling and measurement of energy dissipation in non-equilibrium systems
- Characterization and tuning of phonon transport across dissimilar material interfaces

### Recent Publications

- Z.-Y. Ong and E. Pop, "A two-temperature model of narrow-body silicon transistors under steady state and transient operation," submitted, 2008.
- E. Pop, "The role of electrical and thermal contact resistance for joule breakdown of single-wall carbon nanotubes," *Nanotechnology*, vol. 19, p. 295202, 2008.
- S. Verma, E. Pop, P. Kapur, K. Parat, and K. Saraswat, "Operational voltage reduction of flash memory using high- $\kappa$  composite tunnel barriers," *IEEE Electron Device Letters*, vol. 29, p. 252, 2008.

### Recent Presentations

- "Electron-Phonon Interaction and Joule Heating in Nanostructures." Keynote talk at ASME, 3rd Energy Nano International Conference (ENIC2008), Jacksonville, Florida, August 2008.
- "Power Dissipation and Heat Transport in Dimensionally Mismatched Materials and Devices." 6th USA-Japan Joint Seminar on Nanoscale Transport, MIT, Cambridge, Massachusetts, July 2008.
- "Memory Technology: Putting the 'Nano' in Your iPod." Invited talk at University High School, Urbana, Illinois, May 2008.

### Honors

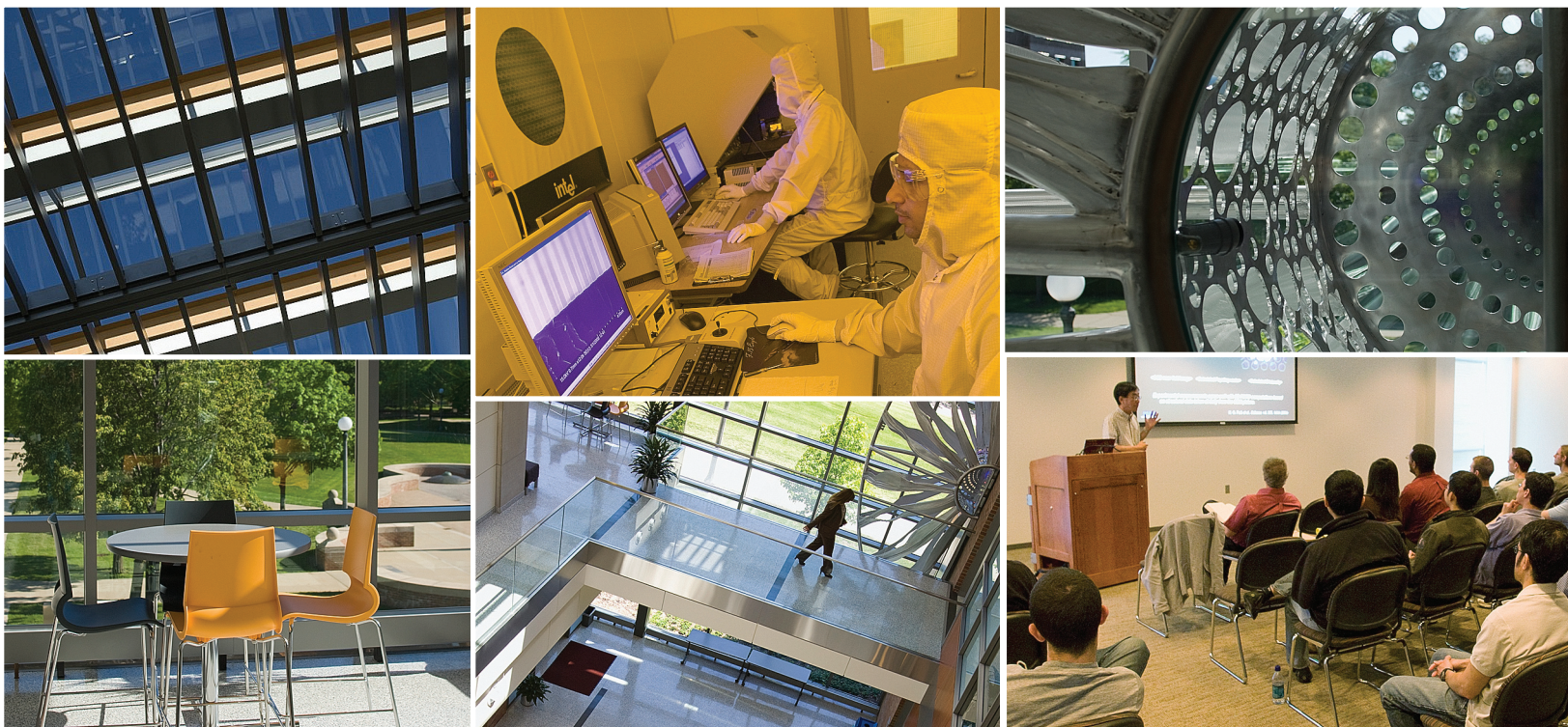
- DARPA Young Faculty Award (YFA), 2008
- Arnold O. Beckman Research Award, 2007
- SRC Graduate Fellowship, 2001-2004

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## Multidisciplinary Research at the Micro and Nanotechnology Laboratory

### Center for Nanoscale Science and Technology

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### Network for Computational Nanotechnology/NanoHub

1250 Micro and Nanotechnology Laboratory

Nahil Sobh, Site Lead  
 Umberto Ravaioli, Faculty Lead  
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### Siteman Center of Cancer Nanotechnology Excellence (SCCNE) (Illinois co-location)

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Rashid Bashir, Principal Investigator  
 Irfan Ahmad, Project Coordinator/Co-Principal Investigator  
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### National Centers at Illinois Utilizing the MNTL

#### Nano-CEMMS Center (NSF-NSEC)

Placid Ferreira, Director  
[www.nano-chemms.uiuc.edu](http://www.nano-chemms.uiuc.edu)

#### Center for the Design of Biomimetic Nanoconductors (NIH-NDC)

Eric Jakobsson, Director  
[www.nanoconductor.org](http://www.nanoconductor.org)

#### The WaterCAMPWS (NSF-ERC)

Mark Shannon, Director  
[www.watercampws.illinois.edu](http://www.watercampws.illinois.edu)

### MNTL Faculty Participation with External Centers

#### NIH Nanomedicine Development Center: Phi29 DNA-Packaging Motor for Nanomedicine

Rashid Bashir, Co-Principal Investigator  
[www.vet.purdue.edu/PeixuanGuo/NDC/index.html](http://www.vet.purdue.edu/PeixuanGuo/NDC/index.html)

#### Center for Food Safety Engineering (USDA/ARS)

Rashid Bashir, Co-Principal Investigator  
[www.cfse.purdue.edu](http://www.cfse.purdue.edu)

#### Center for Affordable Nanoengineering of Polymer Biomedical Devices (NSF-NSEC)

Rashid Bashir, Co-Principal Investigator  
[www.nsec.ohio-state.edu/overview\\_1.html](http://www.nsec.ohio-state.edu/overview_1.html)