



**nano@illinois**<sup>TM</sup>

*nano solutions for mega problems*

## CNST Annual Nanotechnology Workshop 2011

### nPEAP Workshop

**May 12–13, 2011**

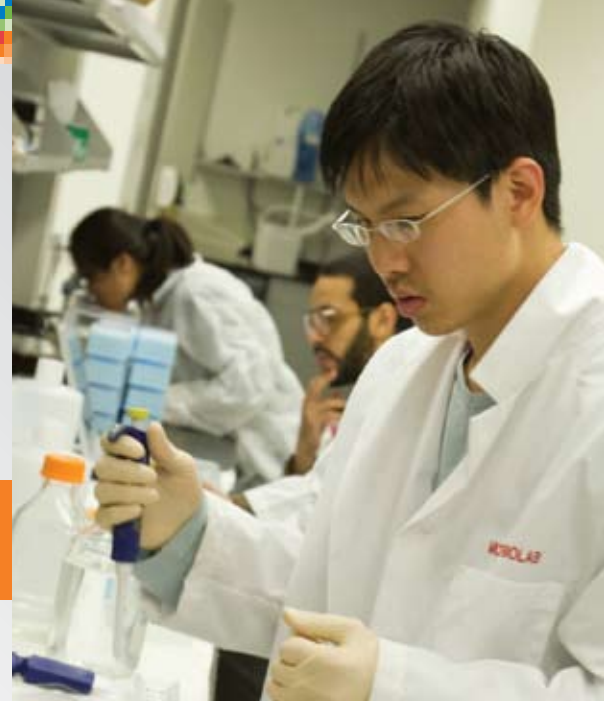
**Beckman Institute for Advanced Science and Technology  
and Micro and Nanotechnology Laboratory  
University of Illinois at Urbana-Champaign**

Showcasing University of Illinois research in bionanotechnology/nanomedicine, nanoelectronics/nanophotonics, and nanomaterials/nanomanufacturing, leading to cross-campus and industry collaborations.

### nPEAP

The **nano-Photonics and Electronics Industry Affiliates Program** focuses on cutting-edge nano-photonics and electronics research.

**For Technical Collaboration Contact:  
Center for Nanoscale Science and Technology  
University of Illinois  
217-333-2015  
nanotechnology@illinois.edu  
www.cnst.illinois.edu**



### Sponsor

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- NSF Center on Emergent Behaviors of Integrated Cellular Systems (EBICS, co-location)
- NanoHub at Illinois
- Nanotechnology Community of Scholars at ACES
- US Army TATRC: Micro and Nano-mediated 3D Stereo Lithography



ILLINOIS

# CNST Annual Nanotechnology Workshop 2011

Venue: Beckman Institute for Advanced  
Science and Technology

Thursday, May 12

7:30-8:15 AM **Registration and Breakfast at Beckman**  
Plenary Session at Beckman Auditorium

8:30-10:00 AM **Plenary Session Chair: Rashid Bashir,**  
**Director, Micro and Nanotechnology**  
**Lab**

8:30 **Center for Nanoscale Science and**  
**Technology**

8:35 **Welcome Remarks**

**Robert Easter**; Interim Vice President  
and Chancellor, University of Illinois

**Ilesanmi Adesida**, Dean, College of  
Engineering; Founding and Co-Director,  
CNST, University of Illinois

**Herbert Whiteley**, Dean, College of  
Veterinary Medicine, University of  
Illinois

**nano@Illinois**: Center for Nanoscale  
Science and Technology (CNST)

**Rashid Bashir**, Co-Director, CNST,  
Director, MNTL and

**Irfan Ahmad**, Executive Director, CNST

9:00 **Keynote**

**Overview of IBM Watson Labs**  
**Nanoscience and Nanotechnology**  
**Research**

**Thomas Theis**, Program Manager,  
New Devices and Architectures for  
Computing, IBM

10:00 **Coffee Break**

## Nanoelectronics, Nanomaterials, and Nanomanufacturing Session A

10:30-12:00 **Session I Chair: David Cahill**, Professor  
and Head, Department of Materials  
Science and Engineering

10:30 **Novel Printing Approaches for**  
**Microelectrode Architectures on**  
**Flexible, Rigid, and Curvilinear**  
**Substrates**

Jennifer Lewis, Materials Science and  
Engineering/FSMRL, Illinois

10:50 **Modeling Graphene Nanoelectronics:**  
**History Repeats Itself**

Jean-Pierre Leburton, Electrical and  
Computer Engineering

11:10 **In-Situ TEM Investigations of**  
**Nanoscale Energy Systems in Relevant**  
**Environmental Conditions**  
Shen Dillon, Materials Science and  
Engineering

11:30 **Nanoengineering of High Power and**  
**Energy Density Rechargeable Batteries**  
Paul Braun, Materials Science and  
Engineering

11:50 **Engineering New Functionalities**  
**in Materials: Complex Oxide Thin**  
**Films and Nanostructures for Next**  
**Generation Devices**  
Lane Martin, Materials Science and  
Engineering

12:10 **Lunch and Performance**  
Beckman Atrium

## Nanoelectronics, Nanomaterials, and Nanomanufacturing Session B

1:15-2:15 PM **Session II Chair: Edmund Seebauer**,  
Professor and Head, Chemical and  
Biomolecular Engineering

1:15 **A perspective on Challenges in**  
**Nanoscale Manufacturing**  
Placid Ferreira, Mechanical Science and  
Engineering

1:35 **3D Topological Insulator-**  
**Superconductor Heterostructures:**  
**From Wormholes to Vortices**  
Matthew Gilbert, Electrical and  
Computer Engineering

1:55 **Gas Detection using Sub-wavelength**  
**Structures on Fiber Tips**  
Lynford Goddard, Electrical and  
Computer Engineering

2:15 **Coupled Electro-Thermal Simulation of**  
**Semiconductor Devices**  
Umberto Ravaioli, Electrical and  
Computer Engineering

2:35 **Coffee Break**

## Bionanotechnology and Nanomedicine\*

3:00-4:45 PM **Session III Chair: Gene Robinson**,  
Professor and Director, Institute for  
Genomic Biology

3:00 **Nanoscale Force Sensors for Biological**  
**Applications**  
Taher Saif, Mechanical Science and  
Engineering

3:20 **Silicon Photonics: An Enabling**  
**Technology for Multiplexed Bioanalysis**  
Ryan Bailey, Chemistry

3:40 **Nanotherapeutics for Cancer**  
**Treatment**  
JJ Cheng, Materials Science and  
Engineering

- 4:00 Cell Transplantation Device for Neovascularization: Integration of Material Chemistry and Microfabrication**  
Hyunjoon Kong, Chemical and Biomolecular Engineering
- 4:20 Micro and Nano Printing for understanding Cell-material Interactions**  
Amy Wagoner-Johnson, Mechanical Science and Engineering
- 4:40 Microfluidic Platforms for Protein Crystallization and *in situ* Structure Determination**  
Paul Kenis, Chemical and Biomolecular Engineering

## Session IV

- 5:15-7:00 PM Poster Session\* and Reception at Micro and Nanotechnology Laboratory**  
Moderators: Lizanne DeStefano, Educational Psychology, and Irfan Ahmad, CNST/ABE, Illinois
- 7:30 PM Dinner/Speech (by invitation)**  
TBA  
I-Hotel, University of Illinois Research Park

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*\*includes presentations by faculty and students affiliated with the following multidisciplinary centers and projects:*

- *NSF IGERT (CMMB) Cellular and Molecular Mechanics and BioNanotechnology*
- *M-CNTC: Midwest Cancer Nanotechnology Training Center (NIH/NCI)*
- *EBICS: Emerging Behaviors of Integrated Cellular Structures Center (NSF STC)*
- *US Army TATRC: Micro and Nano-mediated 3D Stereo Lithography*

## CNST Workshop Organizing Committee

**Irfan Ahmad**, Co-Chair, and Agricultural and Biological Engineering, CNST, MNTL

**Rashid Bashir**, Co-Chair, and Electrical and Computer Engineering, MNTL, CNST

**Rohit Bhargava**, Bioengineering

**JJ Cheng**, Materials Science and Engineering

**Lizanne DeStefano**, Educational Psychology

**Timothy Fan**, Veterinary Clinical Medicine

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

**Yi Lu**, Chemistry

**Joseph Lyding**, Electrical and Computer Engineering

## Workshop Premise

The broad objective of the University of Illinois Center for Nanoscale Science and Technology (CNST) workshop is to showcase University of Illinois research in bionanotechnology/ nanomedicine, nanoelectronics/ nanophotonics, nanomaterials/nanomanufacturing, and computational nanotechnology/nanomechanics.

The general framework of the nanotechnology workshop is similar to those held on campus since 2003; which were all well attended by industry and academia. Some of those interactions have since then led to industry and cross-campus collaborations. The CNST-led forums and workshops have contributed tremendously toward the formation of multidisciplinary teams leading to the establishment of multi-million dollar new nanotechnology centers on-campus.

The workshop will provide a forum for industry interactions and collaborations. The workshop brings together campus community (faculty, postdocs, graduate and undergraduate students, administration) from the University of Illinois and industry engaged in cutting-edge research. A workshop panel will discuss the roadmap to future direction of research and development in nanotechnology and regional partnerships.

**Format:** The two-day workshop is being held on May 12 and 13, 2011 in conjunction with nPEAP (Nano Photonics and Electronics Affiliates Program) workshop at the renowned Beckman Institute and the Micro and Nanotechnology Laboratory at the University of Illinois at Urbana-Champaign. The workshop programs includes plenary session speeches, technical and poster sessions, nPEAP roadmap discussions, and best student poster awards, in addition to networking opportunities during lunch and dinner receptions. Outreach efforts involve participation of high school students and radio interviews on nanotechnology at Illinois.

**Sponsors:** University of Illinois  
Center for Nanoscale Science and Technology  
[www.cnst.illinois.edu](http://www.cnst.illinois.edu)

# nPEAP

## Nano Photonics and Electronics Industry Affiliates Program

Venue: Micro and Nanotechnology  
Laboratory (MNTL) Seminar Room 1000

Friday, May 13

7:00-8:00 AM **Continental Breakfast  
Micro and Nanotechnology  
Laboratory Atrium**

### Nanoelectronics: High Speed Nanotransistor for Energy Efficient Electronics

8:00-10:00 AM **Session I: Chair: Milton Feng, ECE/  
MNTL, nPEAP, Co-Chair**

8:00 **Welcome Remarks**

**Michael Bragg**, Executive Associate  
Dean, College of Engineering, and  
Professor of Aerospace Engineering

**Andreas Cangellaris**, Head, Department  
of Electrical and Computer Engineering,  
and M.E.Van Valkenburg Professor of  
Electrical and Computer Engineering

8:15 **Keynote**

***Emerging Device Nanotechnology  
Research for Future Computing and  
SOC Nanoelectronics***

**Dr. Robert Chau**, Intel Senior Fellow  
and Director of Transistor Research and  
Nanotechnology

**Invited Talks:**

8:45 **The Challenges Facing the Advanced  
Logic Technologies in the Near to Long  
Term**

Dr. Carlos Diaz, TSMC Director of  
Advanced Device Technology and TCAD  
(Taiwan Semiconductor)

9:15 **Type II InP DHBT and ICs for Agilent  
Instruments**

Dr. Barry Wu, Senior Researcher (MBE  
and Mixed Signal ICs), Agilent, Santa  
Rosa, CA

9:45 **The Metamorphosis of the Transistor  
into a Transistor Laser Modulated at  
40 Gb/s**

Milton Feng, Nick Holonyak Jr. Chair,  
Professor of Electrical and Computer  
Engineering; and Nick Holonyak,  
Jr., John Bardeen Endowed Chair,  
Professor of Electrical and Computer  
Engineering, MNTL

10:15 **Coffee Break**

## Nanophotonics and Optoelectronics

10:30-12:00 **Session II: Chair: Shun- Lien Chuang,  
ECE/MNTL**

10:30 **Photonic Crystal VCSELs for Emerging  
Applications**

Kent Choquette, Abel Bliss Professor of  
Electrical and Computer Engineering,  
MNTL

10:50 **Nanolasers on Silicon Substrate: What  
is the Smallest Semiconductor Laser  
one can make?**

Shun Lien Chuang, Robert C.  
MacClinchie Distinguished Professor of  
Electrical and Computer Engineering,  
MNTL

11:10 **Recent Advances in Microcavity  
Plasmas: Transistors, Coupled Arrays,  
and Light Tiles for General Illumination**

J. Gary Eden, Gilmore Family Endowed  
Professor of Electrical and Computer  
Engineering

11:30 **Blue Waters and Beyond—Unsatisfiable  
Demand for Increased Bandwidth and  
Reduced Power Consumption**

Wen-Mei Hwu, AMD Jerry Sanders  
Chair, Professor of Electrical and  
Computer Engineering, Coordinated  
Science Laboratory

11:50 **Coffee Break**

## Nanotechnology

12:00-1:20 PM **Session III: Chair: Joseph Lyding,  
ECE/Beckman**

12:00 **III-V Nanoelectronic and Nanophotonic  
Devices: Towards Controllability and  
Manufacturability**

Xiuling Li, Electrical and Computer  
Engineering, MNTL

12:20 **Carbon-Based Low-Power Electronics**

Eric Pop, Electrical and Computer  
Engineering, MNTL

12:40 **Nanostructured Silicon  
Thermoelectrics: Science and  
Engineering**

Sanjiv Sinha, Mechanical Science and  
Engineering, Nano-CEMMS

1:00 **Graphene: Edges and Defects**

Joseph Lyding, Electrical and Computer  
Engineering, Beckman Institute

1:20 **Box Lunch Break and Poster Session**

1:45-2:30 **Discussion on nPEAP: Roadmap**

Co-chairs: Milton Feng, Nick Holonyak  
Jr. Chair, Professor of Electrical and  
Computer Engineering

Joseph Lyding, Electrical and Computer  
Engineering, and Beckman Institute

3:20 **Overview of CNST and nPEAP  
Workshops**

**Best Student Poster Awards**

**3:45 Closing Remarks:**

Ravi Iyer, Vice Chancellor for Research, and George and Ann Fisher Distinguished Professor of Electrical and Computer Engineering, Coordinated Science Laboratory

**4:00 Adjourn**

**4:10-5:00 Lab Tours: MNTL and FSMRL**  
(Tour duration: 20 minutes; tours start at 20 minute interval from 4:10 PM)

## Workshop Registration, Poster Signup, and Hotel Information

**Registration Required.** Seating is limited, so register early online: [www.cnst.illinois.edu](http://www.cnst.illinois.edu)

**Workshop Location:** Beckman Institute for Advanced Science and Technology, and Micro and Nanotechnology Laboratory

**For parking directions** to the Beckman or the Micro and Nanotechnology Laboratory at the University of Illinois at Urbana-Champaign visit: [www.cnst.illinois.edu](http://www.cnst.illinois.edu)

**Hotels:** I-Hotel, Hampton Inn, and Illini Union

## nPEAP Workshop Organizing Committee

**Milton Feng**, Co-Chair, Nick Holonyak Jr. Chair, Professor of Electrical and Computer Engineering

**Joseph Lyding**, Co-Chair, Professor of Electrical and Computer Engineering, Beckman

**Shun-Lien Chuang**, Robert C. MacClinchie Distinguished Professor of Electrical and Computer Engineering

**James Coleman**, Intel Alumni Endowed Chair, Professor of Electrical and Computer Engineering

**Eric Pop**, Electrical and Computer Engineering

**Rashid Bashir**, Abel Bliss Professor of Electrical and Computer Engineering, and of Bioengineering, Director, MNTL, CNST

**Irfan Ahmad**, Agricultural and Biological Engineering, CNST, MNTL

**Sophi Martin**, Office of Research, College of Engineering

## About nPEAP

### nano-Photonics and Electronics Industry Affiliates Program

The University of Illinois welcomes its valued industry partners to the launch of a new affiliates program focused on cutting-edge nano-photonics and electronics research. The nano-Photonics and Electronics Industry Affiliates Program (nPEAP) workshop being held in conjunction with the University of Illinois Center for Nanoscale Science and Technology Annual Nanotechnology Workshop, will highlight the cutting edge and ground breaking research currently underway at the University of Illinois and look toward new directions and opportunities for research in these areas, which will define the future. In addition, the forum will serve as a springboard for initiating discussions among industry leaders and academia on developing meaningful, tangible, and mutually beneficial research and development partnerships. We welcome you to the beautiful and sprawling campus of the University of Illinois at Urbana-Champaign for this exciting event.

University of Illinois researchers have made profound contributions in development of electronic and photonic devices. The recently released nano@illinois research faculty handbook profiles some of the leading researchers and their innovations. These developments have had tremendous impact on industry at large, some of these innovations have spanned into multi-billion industry. While the need for scaling of electronic and photonic devices and systems continues to increase, the technical challenges for such scaling also continue to rise. Our world class faculty and research leaders expect to continue vigorous interactions with industry for the benefit of all involved. The purpose of initiating this affiliate program is to reinvigorate, formalize, and strengthen these interactions between the University of Illinois faculty and the industry in the areas of photonics and electronics.

There also is a rich and long history of University of Illinois faculty engaging with industry in a previous affiliate program called PEAP (Physical Electronic Affiliate Program). That program, which was active in late eighties to late nineties, brought industry leaders to campus once a year in a pre-competitive environment for faculty research presentations, exchange of ideas, and industry interactions with graduate students. The newly proposed effort envisages to build on the tradition of academia-industry partnership, a hallmark of the University of Illinois, as there is now a renewed need for such interactions, as the magnitude of challenges and opportunities continues to rise in scaling and development of electronic and photonic devices, materials, and systems.

### Proposed Topics and Discussions

- Grand challenges in electronic and photonic scaling and integration incorporating materials, devices, and systems
- Device Modeling; Understanding and discovering new circuit/device properties.
- Novel Devices and Materials: Meeting and exceeding year 2020+ performance requirements
- End of road-map lithography need and solutions
- Industry perspective on next generation workforce hiring needs?
- Where do you see your particular industry heading in the next 5, 10, or 20 years?
- Networking events to meet students and researchers on campus who are and will continue to do exciting work in electronics/photonics.
- Historical perspective on affiliates program (PEAP) and plans moving forward
- Laboratory tours and brief update on recently funded multidisciplinary nanotechnology centers

## nano@illinois

Established in 2001-02, the University of Illinois Center for Nanoscale Science and Technology (CNST) is the premier center for nanotechnology research, education and training, and entrepreneurial and outreach activities. CNST draws its strength from working as a collaborative involving the Beckman Institute for Advanced Science and Technology, Roy J. Carver Biotechnology Center, Coordinated Science Laboratory, Frederick Seitz Materials Research Laboratory, Institute for Genomic Biology, Micro and Nanotechnology Laboratory, Center for Nanoscale Chemical, Electrical, Mechanical, Manufacturing Systems, National Center for Supercomputing Applications, the Schools of Chemical Sciences and of Molecular and Cellular Biology, and other multidisciplinary centers. It brings together nanoscale research from across the campus, drawing faculty from engineering, chemistry, physics, biology, neuroscience, agriculture, medicine, and other areas. The center envisions seamless integration of research from materials to devices to systems and applications.

CNST is uniquely located to harness the innovation-based entrepreneurial and technical spirit in downstate Illinois, with ongoing linkages with the University Research Park, the Illinois Department of Commerce and Economic Opportunity, and the State legislature. Industrial and international linkages have also been initiated through multidisciplinary centers. In addition, CNST has embarked on developing a curriculum for nanotechnology education, which will transcend a number of campus departments and units. Exceptional students with interest in nanotechnology projects have been awarded fellowships, as the center prepares the next generation workforce. CNST-led efforts have led to leveraging of existing nanotechnology research labs into also hands-on training sites for molecular and cellular biology, mechanobiology, micro and nanofabrication, and enabling technologies, and tissue engineering.



CNST University of Illinois Center for Nanoscale Science and Technology

The CNST thrives on its cutting-edge core research in bionanotechnology, computational nanotechnology, nanocharacterization, nanoelectromechanical systems, nanoelectronics, nanofabrication, nanomaterials, and nanophotonics. Translational areas include: nanoagriculture and food, nanoenvironment, nanomanufacturing, nanomedicine, nanosecurity, and societal implications of nanotechnology.

For more information visit: [www.cnst.illinois.edu](http://www.cnst.illinois.edu) or email: [nanotechnology@illinois.edu](mailto:nanotechnology@illinois.edu) or call 217-244-1353.

## Keynote Speaker



### Thomas N. Theis, Ph.D.

*Program Manager, New Devices and Architectures for Computing IBM*

Thomas Theis received a B.S. degree in physics from Rensselaer Polytechnic Institute in 1972, and M.S. and Ph.D. degrees from Brown University in 1974 and 1978, respectively. A portion of his Ph.D. research was done at the Technical University of Munich, where he completed a postdoctoral year before joining IBM Research in 1979.

Dr. Theis joined the Semiconductor Science and Technology Department at IBM Watson Research Center in December of 1978. Since then he has made important contributions to the understanding of conduction in wide-band-gap insulators and donors in III-V compound semiconductors and has contributed as a manager and technical strategist to the development of technology products including IBM's introduction of copper wiring technology in the late 1990's. As IBM's world-wide director for research in the physical sciences from 1998 to 2010, he championed successful new research initiatives in nanoelectronics, nanophotonics, exploratory memory devices, quantum computing, and "green" technology. In June of 2010, he assumed his present position as Program Manager, New Devices and Architectures for Computing. Tom is a Fellow of the American Physical Society and serves on numerous advisory boards and committees. He is proud to have served on the National Academies committees that authored the first and second triennial reports on the National Nanotechnology Initiative, and to have recently served on the committee that authored the Report to the President and Congress on the Third Assessment of the National Nanotechnology Initiative.

### Abstract

#### **Beyond Silicon: Nanoscale Science and Technology at IBM**

Nanotechnology is the future of information technology, so it should be no surprise that IBM Research pursues a broad range of research topics in nanoscale science and technology. But how are projects chosen and supported? First, we invest in core research competencies. Specifically, we seek to advance the state of the art in selected processes for materials synthesis and device fabrication, instruments for nanoscale imaging and characterization, and computational and theoretical techniques for modeling

nanostructured materials and nanoscale devices. These core competencies support our primary research focus—the exploration of new devices to store, communicate, and process information. Examples of new devices to store information include random access memories based on magnetic tunnel junctions and on phase change materials. Our research on new devices to communicate information is focused on nanophotonics, where we aim to build a complete wave-length-multiplexed optical communications network on a silicon chip. An example of a new device to process information is the carbon nanotube transistor, but we are also exploring more exotic device concepts with the potential to operate with greatly reduced power dissipation — beyond the limits of any conventional field effect transistor. While our primary objective is the exploration and development of such new devices for information

technology, we are also partnering with other companies and research organizations to explore applications of nanotechnology in other industries. One example that has received some press recently is our development of a liquid-solution-based process for the fabrication of thin-film solar cells. The underlying synthetic process was originally developed for the fabrication of thin-film transistors. Another example is our demonstration of new membrane materials for improved filtration of water— research which leverages expertise in polymer chemistry originally developed in support of microelectronics manufacturing. In general, the ability to pattern materials on ever smaller scales and synthesize structures on ever larger scales is driving novel applications well outside the traditional domains of information technology and industrial chemistry where these techniques emerged.

## Keynote Speaker



### Robert Chau, Ph.D.

*Intel Fellow and Director of Transistor Research and Nanotechnology, Intel Corporation*

Robert Chau received the B.S., M.S., and Ph.D. degrees in electrical engineering from The Ohio State University.

Dr. Robert Chau is an Intel Senior Fellow and Director of Transistor Research and Nanotechnology in the Technology and Manufacturing Group of Intel Corporation. He is responsible for directing research and development in advanced transistors and gate dielectrics, process modules and technologies, and integrated processes for microprocessor and SOC applications. He is also responsible for leading research efforts in emerging nanotechnology for future nanoelectronics applications.

Dr. Chau joined Intel in 1989, became an Intel Fellow in 2000 and an Intel Senior Fellow in 2005. He was the co-recipient of the 2008 SEMI Award for North America for the development of Intel's 90nm strained silicon technology, and the 2008 EDN (Electronics Design, Strategy, News) "Innovator of the Year" award for the development of Intel's 45nm high-k metal gate transistor technology. He holds more than 200 issued U.S. patents and has been elected an IEEE Fellow. In April 2010 Dr. Chau was recognized by the newspaper The Oregonian as the most prolific inventor in the State of Oregon.

## Abstract

### Emerging Device Nanotechnology Research for Future Computing and SOC Nanoelectronics

The presentation will cover two topics: (1) integration of III-V compound semiconductors on Si substrate for future digital CMOS and SOC applications, and (2) research progress on forward-looking devices beyond CMOS for future nanoelectronics.

The first topic will summarize recent research progress made on the InGaAs quantum well field effect transistor (QWFET) and its integration on Si substrate for future high-speed and low-voltage (e.g. 0.5V) logic applications. For example, enhancement-mode InGaAs QWFETs with high-K gate dielectrics have been fabricated on silicon substrate, and achieved  $f_T > 400\text{GHz}$  at low operating voltage of 0.5V. It has been proposed that InGaAs n-channel QWFET be combined with the high-mobility Ge p-channel FET to form a non-silicon channel CMOS architecture on silicon substrate for future high-speed and low-power CMOS applications. In addition, successful integration of wide band gap III-V materials (e.g. GaN) on large silicon substrate will enable many useful functionalities for future SOC's.

The second topic will describe research effort and progress made on forward-looking devices beyond CMOS. In this research space, carbon-based, spin-based, tunnel-based and exciton-based devices are being explored as alternative switches/devices to either replace CMOS after 2020 or combine with CMOS to create new circuit functionalities for future SOC nanoelectronics applications. These emerging devices exhibit unique and interesting characteristics which will be discussed.



# CENTER FOR NANOSCALE SCIENCE AND TECHNOLOGY

University of Illinois at Urbana-Champaign

## nano@illinois—Multidisciplinary Research: Collaboratory

### Center for Nanoscale Science and Technology (CNST)

1102-04 Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Rashid Bashir and Ilesanmi Adesida, Co-Directors  
Irfan Ahmad, Executive Director  
(217) 333-2015 • [www.cnst.illinois.edu](http://www.cnst.illinois.edu)

### Beckman Institute for Advanced Science and Technology (BI)

405 North Mathews Avenue, Urbana, IL 61801-2300  
Arthur Kramer, Director; Van Anderson, Associate Director  
(217) 244-1176 • [www.beckman.illinois.edu](http://www.beckman.illinois.edu)

### Center for Agricultural, Biomedical, and Pharmaceutical Nanotechnology (CABPN) (NSF-I/UCRC)

1102-04 Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Brian Cunningham, Director  
Irfan Ahmad, Associate Director/Industry Liaison  
[www.cnst.illinois.edu/cabpn](http://www.cnst.illinois.edu/cabpn)

### Center for Cellular Mechanics (CCM)

2101D Mechanical Engineering Laboratory  
1206 West Green Street, Urbana, IL 61801  
Taher Saif, Director  
(217) 333-8552 • [www.ccm.illinois.edu](http://www.ccm.illinois.edu)

### Center for Directed Assembly of Nanostructures (CDAN)\* (co-location)

2015 Frederick Seitz Materials  
Research Laboratory  
104 South Goodwin Avenue, Urbana, IL 61801  
Kenneth Schweizer, Site Lead  
(217) 333-6440 • [www.mrl.illinois.edu](http://www.mrl.illinois.edu)

### Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS)\*

4410 Mechanical Engineering Laboratory  
105 South Mathews Avenue, Urbana, IL 61801  
John Rogers, Director; Polly Kroha, Managing Director  
(217) 265-0093 • [www.nano-cemms.illinois.edu](http://www.nano-cemms.illinois.edu)

### Center of Advanced Materials for Purification of Water with Systems (WaterCAMPWS)\*

2127 Mechanical Engineering Laboratory  
1206 West Green Street, Urbana, IL 61801  
Benito Marinas, Acting Director; Brian Pianfetti, Associate Director  
(217) 333-2633 • [www.watercampws.illinois.edu](http://www.watercampws.illinois.edu)

### Center on Emergent Behaviors of Integrated Cellular Systems (EBICS)\*

1102A Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Jimmy Hsia, Education Director  
Phoebe Lenear, Education Program Manager  
(217) 333-2321

### Coordinated Science Laboratory (CSL)

202 Coordinated Science Laboratory  
1308 W. Main Street, Urbana, IL 61801  
William Sanders, Director; Elizabeth Dennison, Associate Director  
(217) 333-2511 • [www.csl.illinois.edu](http://www.csl.illinois.edu)

### Frederick Seitz Materials Research Laboratory (FSMRL)+

2015 Frederick Seitz Materials  
Research Laboratory  
104 South Goodwin Avenue, Urbana, IL 61801  
Jennifer Lewis, Director  
Kris Williams, Director Operations  
(217) 333-1370 • [www.mrl.illinois.edu](http://www.mrl.illinois.edu)

### Global Enterprise for Micro Mechanics and Molecular Medicine (GEM<sup>4</sup>)

1250 Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Jimmy Hsia, Director  
(217) 244-4102 • [www.gem4.org](http://www.gem4.org)

### Institute for Genomic Biology (IGB)

Institute for Genomic Biology  
1206 W. Gregory Drive, Urbana, IL 61801  
Gene Robinson, Director  
Jennifer Quirk, Associate Director  
(217) 244-2999 • [www.igb.illinois.edu](http://www.igb.illinois.edu)

### Materials Computation Center (MCC)\*

2015 Frederick Seitz Materials  
Research Laboratory  
104 South Goodwin Avenue, Urbana, IL 61801  
Jennifer Lewis, Director  
(217) 265-0319 • [www.mcc.uiuc.edu](http://www.mcc.uiuc.edu)

### Micro and Nanotechnology Laboratory (MNTL)\*

2000 Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Rashid Bashir, Director  
John Hughes, Associate Director Operations  
(217) 333-3097 • [www.mntl.illinois.edu](http://www.mntl.illinois.edu)

### Multidisciplinary University Research Initiative (MURI-ARO)

3264 Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Shun Lien Chuang, Director  
(217) 333-3359 • [muri-t2sl.ece.illinois.edu](http://muri-t2sl.ece.illinois.edu)

### National Center for Supercomputing Applications (NCSA)\* and Institute for Advanced Computing Applications and Technologies

NCSA Building  
1205 West Clark Street, Urbana, IL 61801  
Thom Dunning, Jr., Director  
Danny Powell, Executive Director  
(217) 244-0072 • [www.ncsa.illinois.edu](http://www.ncsa.illinois.edu)

### NIH/NCI Midwest-Cancer Nanotechnology Training Center (M-CNTC)

1256 Micro and Nanotechnology Laboratory  
208 North Wright Street, Urbana, IL 61801  
Rashid Bashir and Ann Nardulli, Co-Directors  
Program Manager: Laura Miller  
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### NIH Resource Center for Macromolecular Modeling and Bioinformatics (RCMMB)

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### Network for Computational Nanotechnology/NanoHub at Illinois\*

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### Innovation-based Entrepreneurship at Illinois

[www.illinois.edu/academics/entrepreneur](http://www.illinois.edu/academics/entrepreneur)

\*Currently/formerly a National Science Foundation Center

\*\* National Cancer Institute Center

+ Currently/formerly a Department of Energy Laboratory/Center