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Cover: The picture is a morphing of the Cincinnati skyline with an AFM scan of a self-assembled array of Lanthanum Sulfide nanowires, each of which produces on the average, a field emission current of 0.2 nA. The artwork was performed by Darren Glavic from the University of Cincinnati.
WELCOME MESSAGE FROM THE GENERAL CO-CHAIRS

On behalf of the conference organizing committee, we would like to welcome you to the sixth IEEE Conference on Nanotechnology. After successful conferences in Maui, Washington DC, San Francisco, Munich, and Nagoya, the conference returns to the U.S. heartland, Cincinnati.

The conference is sponsored by the IEEE Nanotechnology Council to provide a forum for the exchange of ideas on the latest research results and for the discussion of various topics in nanoscience and nanotechnology. The conference provides a good place for networking with colleagues, and for potential future collaboration on nanotechnology research and development.

Since its formation in 2001, the IEEE Nanotechnology Council has served as the focal point for all nanotechnologies activities within the IEEE and the broad nanotechnology community in the U.S. and worldwide. This IEEE-NANO is the flagship conference for the Council, and is a must-attend conference for all those interested in the latest advances in nanotechnology.

The Program Committee, co-chaired by Supriyo Bandyopadhyay and Marc Cahay, has put together an excellent technical program. The technical program covers major topics in nanotechnology, including many topics on nanoelectronics. In addition, there is a keynote address by Nobel Laureate John Fenn, plenary talks by outstanding researchers, and various invited talks by noted experts on nanotechnology. And if you are new to nanotechnology or if you want to refresh your knowledge, there are tutorials on Monday. There are also special activities for students who want to learn more about this exciting multidisciplinary area called nanotechnology.

Cincinnati, in the heartland of the U.S. Midwest and on the banks of the Ohio River, is a dynamic metropolis with a European flavor. Cincinnati is rich in architecture and culture, with zoos and museums for the young and young at heart. To enrich the enjoyment of your stay in Cincinnati, the organizing committee has set aside Wednesday afternoon for excursions to various attractions. For entertainment at the banquet, we have invited a genuine midwest Blue Grass Band.

We hope you will find the conference informative and productive, and hope you will enjoy your stay in Cincinnati.

Cliff Lau
General Co-Chair

David Janes
General Co-Chair
Welcome Message from the Program Co-Chairs

Welcome to IEEE NANO 2006. We hope that you will enjoy your stay in Cincinnati and the technical program that has been prepared. This year, we tried many new approaches. First, the review system was web based, which made collecting reviews and arranging the sessions easier and more efficient. Second, the entire paper submission, review and revision processes were handled through IEEE. Thanks to Ann Burgmeyer and Deborah Graffox, this was done efficiently and in a timely fashion. The technical program was divided into 13 topical areas, each with a topic leader, and each leader arranged for the reviews within their own topical area. Every paper received a rigorous review and authors were provided with some feedback to improve the quality of their submission. This year we had a record number of submissions. Two hundred and sixty six submissions were received. The final paper statistics is as follows: 1 Nobel Lecture, 5 Plenary Talks, 25 Invited Talks, 171 Oral Presentations, 78 Posters and 17 Rejections.


Additionally there is a rump session to address government and industry funding in various areas of nanoscience and nanotechnology.

Submission statistics by country is summarized below:
Austria (1), Canada (5), China (5), Denmark (1), England (2), France (2), HongKong (1), Italy (4), India (4), Japan (7), Korea (4), Netherlands (1), Russia (1), Singapore (7), Spain (2), Switzerland (2), Taiwan (19) and USA (197).

The chairs of the Technical Program Committee are indebted to the topic leaders and some forty reviewers who helped put together this program. Finally, we thank all the authors who have chosen to contribute to this program. We wish you the best.

Supriyo Bandyopadhyay
Program Co-Chair

Marc Cahay
Program Co-Chair
Organizing Committee Members

General Co-Chairs
Cliff Lau
Institute for Defense Analyses

David B. Janes
Purdue University

Program Co-Chairs
Supriyo Bandyopadhyay
Virginia Commonwealth Univ.

Marc Cahay
University of Cincinnati

Publications Chair
Sanjay Krishna
University of New Mexico

Local Arrangements Chair
Marc Cahay
University of Cincinnati

Finance Chair
Paul Yu
Univ. of California, San Diego

Plenary Speaker Chair
Chennupati Jagadish
Australian National University

Short Courses Chair
Jean Pierre Leburton
Univ. of Illinois-Urbana Champaign

Publicity Chair
Yonhua Tzeng
Auburn University

Conference Registration
Marie Madden
IEEE Conference Management

Exhibit Co-Chairs
John Tucker
Keithley Instruments

Ken Roenker
University of Cincinnati

Student Activities Co-chairs
Chongwu Zhou
University of Southern California

Savas Kaya
Ohio University

Regional Liaison
Parviz Famouri
West Virginia Univ.

Canadian Liaison
David Lockwood
National Research Council Canada

European Liaison
Paolo Lugli
Technical Univ. of Munich

Greater Asia Liaison
Toshio Fukuda
Nagoya University

Peter (Chung-Yu) Wu
National Chiao Tung Univ., Taiwan

Special thanks to Ann Burgmeyer and Deborah Graffox (IEEE)
TECHNICAL PROGRAM COMMITTEE MEMBERS

Chong Ahn, ECECS Department, University of Cincinnati, chong.ahn@uc.edu
Raman Akkipeddi, IMRE, Singapore, ram-akki@imre.a-star.edu.sg
Fumihito Arai, Nagoya University, arai@mein.nagoya-u.ac.jp
Yasuhiko Arakawa, University of Tokyo, arakawa@iis.u-tokyo.ac.jp
Pushan Ayyub, Tata Institute of Fundamental Research, India, pushan@mailhost.tifr.res.in
Chagan Baatar, Office of Naval Research, baatar@onr.navy.mil
Sankar Basu, NSF/CISE, sabasu@nsf.gov
Gary Bernstein, University of Notre Dame, gary.h.bernstein.1@nd.edu
Pallab Bhattacharya, University of Michigan, pkb@eecs.umich.edu
Dieter Bimberg, Technical University of Berlin, bimberg@physik.tu-berlin.de
Rober Chau, Intel, robert.s.chau@intel.com
Jia Chen, IBM Research, chenjia@us.ibm.com
Jagadish Chennupati, Australian National University, cjx109@rsphysl.anu.edu.au
James J. Coleman, University of Illinois at Urbana-Champaign, jcoleman@uiuc.edu
Dennis G. Deppe, University of Central Florida, ddeppe@creol.ucf.edu
Ananth Dodabalapur, University of Texas at Austin, ananth@mer.utexas.edu
Steve Fairchild, WPFB, Steven.Fairchild@wpfab.af.mil
David Ferry, Arizona State University, ferry@asu.edu
Jose Fortes, University of Florida-Gainesville, fortess@ufl.edu
Michael Gal, University of New South Wales, M.Gal@unsw.edu.au
Steve Goodnick, Arizona State University, stephen.goodnick@asu.edu
Bruce Hinds, University of Lexington, bjhinds@engr.uky.edu
Faqir Jain, University of connecticut, fcj@engr.uconn.edu
F.H. Julien, University of Paris-Sud, France, francois.julien@ief.u-psud.fr
Shashi Karna, US Army Research Laboratory, skarna@arl.army.mil
Sanjay Krishna, University of New Mexico, skrishna@chtm.unm.edu
Geng-Sheng Kuo, National Chengchi University/Taiwan, gskuo@ieee.org
Jean-Pierre Leburton, UIUC Urbana-Champaign, leburton@ece.uiuc.edu
Yong-Hee Lee, Korea Adv. Inst. of Science and Tech (KAIST), yhlee@mail.kaist.ac.kr
Wen J. Li, The Chinese University of Hong Kong, wen@acae.cuhk.edu.hk
Ching-Fuh Lin, National Taiwan University, cflin@cc.ee.ntu.edu.tw
David Lockwood, National Research Council/Ottawa, david.lockwood@nrc.ca
Paolo Lugli, Technical University of Munich, Germany, lugli@ei.tum.de
Sergey Lyshevski, Rochester Institute of Technology, seleee@rit.edu
Pinaki Majumder, Univ. of Michigan, mazum@eecs.umich.edu
Meyya Meyyappan, NASA Ames Research Center, meyya@orbit.arc.nasa.gov
Saroj Nayak, Rensselaer Polytechnique Institute, nayaks@rpi.edu
Yukinori Ochia, NEC Corporation, ochiai@cw.jp.nec.com
Hideo Ohno, Tohoku University, Japan, ohno@riec.tohoku.ac.jp
Stanley Pau, University of Arizona, Tucson, stanpau@optics.arizona.edu
Ramana Pidaparti, Virginia Commonwealth University, rpmidaparti@vcu.edu
Gernot Pomrenke, AFOSR, gernot.pomrenke@afoasr.af.mil
Paras N. Prasad, State University of New York at Buffalo, pnpurasad@acsu.buffalo.edu
Vladimir Privman, Clarkson University, privman@clarkson.edu
L. Ramdas Ram-Mohan, Worcester Polytechnic Institute, lrram@wpi.edu
Asim Ray, Queen Mary University of London, UK, A.K.Ray@shu.ac.uk
Mettin Setti, Carnegie Mellon University, msetti@andrew.cmu.edu
Vesco Shanov, University of Cincinnati, vesso.shanov@uc.edu
Andrew Steckl, University of Cincinnati, a.steckl@uc.edu
H. Hoe Tan, The Australian National University, hoe109@rsphysse.anu.edu.au
Gary Tepper, Virginia Commonwealth University, gctepper@mail1.vcu.edu
Yonhua Tzeng, ECE Dept., Auburn University, tzengyo@auburn.edu
Osamu Wada, Kobe University, wada@eedept.kobe-u.ac.jp
Kang Wang, UCLA wang@ee.ucla.edu
Joachim Wolter, Eindhoven University of Technology, Netherlands, wolter@ieee.org
H.-S. Philip Wong, Stanford University, hspswong@stanford.edu
J.C. Woo, Seoul National University, jcwoo@plaza.snu.ac.kr
Dwight Woolard, Army Research Office, Dwight.Woolard@us.army.mil
The Nanotechnology Council is part of Division I - Circuits and Devices and is made up of 20 member societies:

- Aerospace & Electronic System Society (AES)
- Antennas & Propagation Society (AP)
- Circuits & Systems Society (CAS)
- Communications Society (COM)
- Components, Packaging, & Manufacturing Technology Society (CPMT)
- Computer Society (C)
- Control Systems Society (CS)
- Electron Devices Society (ED)
- Engineering in Medicine & Biology Society (EMB)
- Electromagnetic Compatibility Society (EMC)
- Industrial Electronics Society (IE)
- Instrumentation & Measurement Society (IM)
- Lasers & Electro-Optics Society (LEO)
- Magnetics Society (MAG)
- Microwave Theory & Techniques Society (MTT)
- Neural Network Society (NN)
- Reliability Society (RL)
- Robotics & Automation Society (RA)
- Systems, Man, & Cybernetics Society (SMC)
- Ultrasonics, Ferroelectrics, & Frequency Control Society (UFFC)
**Program At A Glance**

**Monday, July 17, 2006**
- 8:30 a.m. - 11:30 a.m. Short Courses
- 1:00 p.m. - 2:00 p.m. Symposium on Nanoeducation
- 2:15 p.m. - 5:15 p.m. Short Courses
- 7:00 p.m. - 9:00 p.m. Welcome Party

**Tuesday, July 18, 2006**
- 8:00 a.m. - 8:10 a.m. Welcome Address
- 8:10 a.m. - 9:00 a.m. Keynote Speaker: John Fenn, 2002 Nobel Laureate in Chemistry, Chemistry Department, Virginia Commonwealth University
- 9:00 a.m. - 9:45 a.m. Plenary Speaker: David Miller, Stanford University
- 10:00 a.m. - 12:20 p.m. Morning Symposia
- 11:00 a.m. - 11:20 a.m. Coffee Break
- 12:20 p.m. - 2:00 p.m. Lunch Break
- 2:00 p.m. - 4:20 p.m. Afternoon Symposia
- 3:00 p.m. - 3:20 p.m. Coffee Break
- 7:30 p.m. - 9:30 p.m. Poster Session

**Wednesday, July 19, 2006**
- 8:15 a.m. - 9:00 a.m. Plenary Speaker: T. C. Chen, IBM T.J. Watson Research Center
- 9:00 a.m. - 9:45 a.m. Plenary Speaker: Wei Lu (University of Michigan, Ann Arbor) for Prof. Charles Lieber, Harvard University
- 10:00 a.m. - 12:20 p.m. Morning Symposia
- 11:00 a.m. - 11:20 a.m. Coffee Break
- 12:20 p.m. - 2:00 p.m. Lunch Break
- 2:00 p.m. - 6:00 p.m. Choice of 7 Excursions
- 6:00 p.m. - 7:00 p.m. Rump Session on Funding Opportunities
- 7:00 p.m. - 10:00 p.m. Dinner + Entertainment at the Westin Hotel

**Thursday, July 20, 2006**
- 8:15 a.m. - 9:00 a.m. Plenary Speaker: Jerry Woodall, Purdue University
- 9:00 a.m. - 9:45 a.m. Plenary Speaker: Hank Smith, MIT
- 10:00 a.m. - 12:20 p.m. Morning Symposia
- 11:00 a.m. - 11:20 a.m. Coffee Break
- 12:20 p.m. - 2:00 p.m. Lunch Break
- 2:00 p.m. - 4:35 p.m. Afternoon Symposia
- 3:00 p.m. - 5:00 p.m. Coffee Break
**Keynote and Plenary Speakers**

**Keynote Address**

**Prof. John Fenn**

*Nobel Prize in Chemistry in 2002, Virginia Commonwealth University*  
(8:10-9:00AM, Tuesday, July 18, 2006, Presidential Room I, 3rd level)

**Electrospray Wings for Nanoscale Elephants**

Small effusive leaks into vacuum systems, as in Knudsen cells and classical molecular beam machines, made many contributions to science in the twentieth century. They have continued to serve both science and technology in the early years of the twenty first century. Beginning in the 1950s, big convective leaks have turned out to be even more powerful and versatile tools. The supersonic free jets produced by these big leaks have greatly extended molecular beam methods, become a cornerstone of cluster science and technology, and rewritten the book on molecular spectroscopy. Those jets are now adding new dimensions to the techniques of mass spectrometry by making possible the production of intact ions from the large, complex and fragile species that play such vital roles in living systems. The path from the first crude experiments of Dunoyer into the groves of atomic and molecular physics followed along the trail blazed by Otto Stern and his disciples. That trail was then extended into the fertile fields of chemistry by the likes of Herschbach, Lee, Polanyi, Smalley, Zare and Zewail, five of whom received Nobel Prizes for their contributions. More recently that trail entered the lush gardens of biology where mass spectrometry is providing bumper crops of information and understanding. This travelogue will describe some of the landmarks along what has been a fascinating journey.

**Plenary Speaker**

**Prof. David Miller**  
*Stanford University*  
(9:00-9:45AM, Tuesday, July 18, 2006, Presidential Room I, 3rd level)

**Nanostructured optics and optoelectronics for dense interconnects**

Nanophotonic structures in dielectrics and metals, and quantum well structures in germanium, promise future combined optics, optoelectronics and electronics. Design challenges and approaches for optical devices and recent progress in nanostructured optoelectronics are summarized.

**Plenary Speaker**

**Dr. James Stathis for Dr. T.C. Chen**  
*IBM T.J. Watson Research Center*  
(8:15-9:00AM, Wednesday, July 19, 2006, Presidential Room I, 3rd level)

**Mega-Challenges for Nano-Silicon Technology**

Silicon technology with gate dimensions of a few tens of nanometers is already in mass production. With continued innovation and advancements in materials, lithography tools, and device structures, further scaling down to sub-ten nanometer gate length is planned over the next 10 years. Continued silicon technology scaling faces many challenges, two of the most important being growing standby power dissipation and increasing variability in device characteristics. These effects are frequently cited as the reasons why Moore’s Law is “broken”, or why silicon technology scaling is coming to an end, and why entirely new types of nanotechnology will be needed for higher performance computing architectures in the future. Actually these issues are the embodiments of silicon technology’s approach to atomistic and quantum-mechanical physics boundaries. These same challenges must be met by nano devices in order to be competitive with Silicon technology on a power/performance/cost basis. This talk will describe the power and variability challenges facing silicon technology, in order to set some of the metrics by which nanotechnology can compete with silicon for high performance logic applications.
Plenary Speaker
Prof. Wei Lu, University of Michigan, Ann Arbor, for Prof. Charles Lieber
Harvard University
(9:00-9:45AM, Wednesday, July 19, 2006, Presidential Room I, 3rd level)

Nanowires for Nanoscience and Nanotechnology
Nanoscience offers the promise of producing revolutionary advances in many areas of technology, ranging from electronics and computing to biology and medicine, and thus may impact in a substantial way our future lives. This presentation will provide an overview to the bottom-up paradigm for nanotechnology enabled using nanowire building blocks. First, the growth of nanowires, with composition controlled down to the atomic scale, their fundamental electronic properties, and the assembly of integrated structures will be described. Second, studies of nanowire based electronic circuits and nanocomputing systems will be critically examined. Third, nanowire devices configured as electrically-based biosensors will be discussed with an emphasis on disease detection and ultimate sensitivity limits of these nanodevices, as well as the potential linkage to biological information processing. Challenges and goals that must be met to realize these and other nanotechnologies in the future will be discussed.

Plenary Speaker
Prof. Jerry Woodall
Purdue University
(8:15-9:00AM, Thursday, July 20, 2006, Presidential Room I + II, 3rd level)

QDs and Nanowires: What about surface Fermi level pinning?
It is well known that surface Fermi level pinning limits the design and performance of 2-3D bulk semiconductor devices especially compound semiconductor photonic devices. For example, at GaAs surfaces the Fermi level is pinned near mid gap leading to band bending in both n and p doped material. This band bending causes minority carriers to drift to the surface where they recombine nonradiatively. This results in loss of efficiency in, for example, LEDs and solar cells. There are other undesirable effects as well. For example, surface Fermi level pinning at the air exposed edges in small area diodes and transistors causes excessive perimeter carrier recombination. This results in an "n" factor of 2 in the diode I-V equation. Also, for thin channel MESFETs, the band bending caused by Fermi level pinning can "pinch off" the material between the source-and-gate and drain-and-gate regions. This increases the access resistance and in turn degrades device performance. This last example is of interest to those working to process nano-wires into working devices. It has been observed that surface Fermi level pinning in moderately doped GaAs nano-wires 10:100 nm in diameter can render the wires to be semi insulating. Owing to the current lack of a widely accepted, universal theory of surface Fermi level pinning, it is hard to predict a universal behavior of nano-wire conductivity. Therefore, this talk will be a tutorial review of the salient observations of surface Fermi level pinning in some of the common III-V materials and some of the successful "passivation" techniques. Suggestions for better nano materials will be made. It is hoped that such a review will aid scientists in the quest for real, manufacturable device technologies.

Plenary Speaker
Prof. Hank Smith
Massachusetts Institute of Technology
(9:00-9:45AM, Thursday, July 20, 2006, Presidential Room I + II, 3rd level)

The key role of flexible, low-cost, maskless lithography in nanoscale science and engineering
The role of lithography in the future development of nanoscale science and engineering is to put high-density spatial information into nanoscale assemblies. Because information content determines the functionality of such assemblies, lithography will be a key enabler. Conventional lithographic techniques, such as those developed for the semiconductor industry, lack the flexibility, low cost and the resolution that research in nanoscale science and engineering requires. Although no single lithographic technique is likely to be a panacea, it is important to seek novel approaches that meet the needs of researchers and open a path to directly manipulating nanoparticles and macromolecules. We review the various forms of lithography and focus special attention on maskless zoneplate-array lithography, assessing its impact, advantages and extendibility to the limits of the lithographic process. Nanoscale assemblies will require control at the macromolecular level, and this has begun with research on templated self assembly. Going beyond that to the control and utilization of the information content of nanoparticles and molecules will require innovations whose origin is uncertain at this point.
INVITED SPEAKERS

Prof. John O'Brien, University of Southern California
"Photonic Crystal Devices"

Dr. Mathias Kuntz, Technical University of Berlin
"High-speed quantum dot lasers and amplifiers for optical data communication"

Dr. Sergei Studenikin, Institute for Microstructural Sciences, NRC-Ottawa (Canada)
"Charging characteristics of a few electron triple lateral dot system in GaAs/AlGaAs"

Dr. Eiji Saitoh, Keio University, Japan
"Magnetic resonance coupled with electric and spin currents in NiFe nanostructures"

Prof. Bruce Alphenaar, University of Louisville
"Fabrication of Short-Channel Individual Single-Walled Carbon Nanotubes Devices for Spin Transport Measurements"

Prof. Saroj Nayak, Rensselaer Polytechnique Institute
"First Principles Investigation of Electronic Structure, Magnetic Properties and Spin Polarized Conductance of Self Assembled Molecular Monolayers (SAMs) on Ni(111) Substrate"

Prof. Carlo Montemagno, UCLA & UC
"Engineering and Fabricating a Hybrid Biotic/Abiotic Biological Computer"

Prof. Michael Stroscio, Univ. of Illinois-Chicago
"Integrating Manmade Nanostructures with Biological Structures"

Prof. Harold Craighead, Cornell University
"Nanodevices for Biomolecular Manipulation and Analysis"

Dr. Dieter M. Gruen, Argonne National Laboratory
"The potential of nanostructured carbons as high efficiency high temperature thermoelectric materials for power generation"

Prof. Gerhard Klimeck, Purdue University
"Development and Deployment of Nanoelectronic Applications on the nanoHUB"

Prof. David Ferry, Arizona State University
"Semiconductor Device Scaling: Physics, Transport, and the Role of Nanowires"

Prof. Jagadish Chennupati, Australian National University
"Quantum Dots for Optoelectronic Device Applications"

Prof. Stella Pang, University of Michigan
"Nanoimprint Technology for Three Dimensional Microsystems"

Prof. Steve Brueck, University of New Mexico
"Large-Area Nanophotonics Fabricated By Interferometric Lithography"

Prof. Michael Norton, Marshall University
"Single Molecule Substrates for Lithography"

Prof. Chang Liu, University of Illinois at Urbana-Champaign
"Multifunctional Probe Array and Local Vapor Inking Chip for Scanning Probe Nanolithography"

Dr. Marina Lyshevski, Microsystems and Nanotechnologies
"Synthetic Molecular Machines"

Adam Bange, University of Cincinnati
"Carbon Nanotube Array Immunosensor Development"
### Condensed Meeting Schedule

#### Monday, July 17, 2006

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<tr>
<th>Time</th>
<th>Hayes</th>
<th>Taft I</th>
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<th>Tyler Davidson I</th>
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<td>8:30 - 11:30 a.m.</td>
<td>SC2</td>
<td>SC7</td>
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<td>1:00 - 2:00 p.m.</td>
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<td>S13</td>
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<td>2:15 - 5:15 p.m.</td>
<td>SC3</td>
<td>SC1</td>
<td>SC10</td>
<td>Welcome Party</td>
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<td>7:00 - 9:00 p.m.</td>
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#### Tuesday, July 18, 2006

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<th>Time</th>
<th>Presidential I</th>
<th>Taft I</th>
<th>Taft II</th>
<th>Tyler Davidson I</th>
<th>Tyler Davidson II</th>
<th>Presidential III</th>
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<tr>
<td>8:00 - 8:10 a.m.</td>
<td>Welcome Address</td>
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<td>8:10 - 9:00 a.m.</td>
<td>Keynote Speaker</td>
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<td>9:00 - 9:45 a.m.</td>
<td>Plenary Speaker</td>
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<td>10:00 - 11:00 a.m.</td>
<td>S1 - Part I</td>
<td>S2 - Part I</td>
<td>S3 - Part I</td>
<td>S4 - Part I</td>
<td>S5 - Part I</td>
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<td>11:00 - 11:20 a.m.</td>
<td>Coffee Break</td>
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<td>11:20 a.m. - 12:20 p.m.</td>
<td>S1 - Part I</td>
<td>S2 - Part I</td>
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<td>12:20 - 2:00 p.m.</td>
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<td>2:00 - 3:00 p.m.</td>
<td>S1 - Part II</td>
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<td>S4 - Part II</td>
<td>S5 - Part II</td>
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<td>3:00 - 3:20 p.m.</td>
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<td>3:20 - 4:20 p.m.</td>
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<td>S5 - Part II</td>
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<td>7:30 - 9:30 p.m.</td>
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<td>Poster Session</td>
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**Sessions:**
- S1 Nanoelectronics and Nanodevices
- S2 Nano-Optics, Nano-Photonics, and Nano-Optoelectronics
- S3 Nano-Fabrication, Nano-Lithography, Nano-Manipulation, and Nano-Imaging
- S4 Nano-Sensors and Nano-Membranes
- S5 Nano-Carbon, Nano-Diamond, and Carbon Nanotube Based Technologies
- S6 Modeling and Simulation
- S7 System Integration (Nano/Micro/Macro), NEMs, and Actuators
- S8 Molecular Electronics, Inorganic Nanowires, Nanocrystals, and Quantum Dots
- S9 Spintronics, Nanomagnetics, and Quantum Computing
- S10 Nano-Bio Fusion, Nano-Biology, Nano-Bio-Medical Science
- S11 Nano-Circuits and Architectures
- S12 Nano-Materials and Nano-Structures
- S13 Nanoeducation
# Condensed Meeting Schedule

## Wednesday, July 19, 2006

<table>
<thead>
<tr>
<th>Time</th>
<th>Presidential I</th>
<th>Taft I</th>
<th>Taft II</th>
<th>Tyler Davidson I</th>
<th>Tyler Davidson II</th>
<th>Presidential III</th>
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<tbody>
<tr>
<td>8:15 - 9:00 a.m.</td>
<td>Plenary Speaker</td>
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<td>9:00 - 9:45 a.m.</td>
<td>Plenary Speaker</td>
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<td>10:00 - 11:00 a.m.</td>
<td>S8</td>
<td>S7</td>
<td>S3 - Part II</td>
<td>S9</td>
<td>S5 - Part III</td>
<td>S6</td>
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<tr>
<td>11:00 - 11:20 a.m.</td>
<td>Coffee Break</td>
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<tr>
<td>11:20 - 11:50 a.m.</td>
<td>S8</td>
<td>S3 - Part II</td>
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<tr>
<td>11:20 a.m. - 12:20 p.m.</td>
<td>S8</td>
<td>S9</td>
<td>S5 - Part III</td>
<td>S6</td>
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<tr>
<td>12:20 - 2:00 p.m.</td>
<td>Lunch Break</td>
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<tr>
<td>12:00 - 6:00 p.m.</td>
<td>Choice of 7 Excursions</td>
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<tr>
<td>6:00 - 7:00 p.m.</td>
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<td>Rump Session on Funding Opportunities</td>
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<tr>
<td>7:00 - 10:00 p.m.</td>
<td>Dinner &amp; Entertainment</td>
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## Thursday, July 20, 2006

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<tr>
<th>Time</th>
<th>Presidential I</th>
<th>Taft I</th>
<th>Taft II</th>
<th>Tyler Davidson I</th>
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<tr>
<td>10:00 - 11:00 a.m.</td>
<td>S8 - Part II</td>
<td>S10 - Part I</td>
<td>S12 - Part I</td>
<td>S9 - Part II</td>
<td>S11</td>
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<tr>
<td>11:00 - 11:20 a.m.</td>
<td>Coffee Break</td>
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<td>11:20 - 11:50 a.m.</td>
<td>S9 - Part II</td>
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<tr>
<td>11:20 a.m. - 12:05 p.m.</td>
<td>S8 - Part II</td>
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<tr>
<td>11:20 a.m. - 12:20 p.m.</td>
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<td>S12 - Part I</td>
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<tr>
<td>11:20 a.m. - 12:35 p.m.</td>
<td>S10 - Part I</td>
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<td>S11</td>
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<tr>
<td>12:20 - 2:00 p.m.</td>
<td>Lunch Break</td>
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<tr>
<td>2:00 - 3:00 p.m.</td>
<td>S8 - Part III</td>
<td>S10 - Part II</td>
<td>S12 - Part II</td>
<td>S9 - Part III</td>
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<tr>
<td>3:00 - 3:20 p.m.</td>
<td>Coffee Break</td>
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<tr>
<td>3:20 - 4:20 p.m.</td>
<td>S12 - Part II</td>
<td>S9 - Part III</td>
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<tr>
<td>3:20 - 4:35 p.m.</td>
<td>S8 - Part III</td>
<td>S10 - Part II</td>
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<tr>
<td>1:30 - 3:15 p.m.</td>
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<td>S11 - Special Session</td>
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<td>3:15 - 3:30 p.m.</td>
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<td>Coffee Break</td>
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<tr>
<td>3:00 - 5:00 p.m.</td>
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<td>S11 - Special Session</td>
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</tbody>
</table>
July 17-20, 2006
Location: Westin hotel (site of the conference)
21 E Fifth street, Cincinnati, Ohio

Short Courses
(Second and Third Floor Levels of Westin hotel)
Chair: Jean-Pierre Leburton
University of Illinois
Urbana-Champaign, IL 61801, USA

Morning Session
8:30-11:30 a.m.
The course number (SC#) is the same as the one listed on the registration sheet

SC2: "Nanophotonics Devices Physics and Technology".
(Hayes Room, 3rd level)
D. Deppe, CREOL, University of Central Florida, Orlando

SC7: "Nanostructure Spintronics".
(Taft Room, Section I, 3rd level)
D. Melnikov, UIUC, Urbana

SC8: "Carbon Nanotube based Nanotechnology".
(Taft Room, Section II, 3rd level)
M. Meyyappan, NASA Ames Research Center

S13: Symposium on Nanoeducation
1:00-2:00 p.m.
(Tyler Davidson Room, Section I, 2nd Level)
Session Chair: Marc Cahay
University of Cincinnati

1:00-1:15 p.m.
Multidisciplinary Undergraduate Nano-Science, Engineering and Technology Course
Sergey E. Lyshhevski, John D. Andersen, Stephen Boedo, Lynn Fuller, Ryne Raffaelle, Andreas Savakis, Gary R. Skuse

1:15-1:30 p.m.
Integration of Nanoscale Science and Technology into Undergraduate Curricula
John Bickle, Suri Iyer, Thomas Mantei, Ian Papautsky, Mark Schulz, Vesselin Shanov, Leigh Smith, Andrew Steckl

1:30-1:45 p.m.
An Introductory Course in Nanoelectronics at the Senior/Graduate Level
Kenneth P. Roenker

1:40-2:00 p.m.
First Experiences Teaching Experimental Nanoscale Science and Technology to Undergraduates

Afternoon Session
2:15-5:15 p.m.

SC1: "Nanoelectronics: Physics and Simulation".
(Taft Room, Section I, 3rd level)
S. Datta and M.S. Lundstrom, Purdue University

SC3: "Integrating Nanoelectronics and Biology".
(Hayes Room, 3rd level)
M. Dutta and M. Stroscio, UIUC, Chicago

SC10: "NEMS technology".
(Taft Room, Section II, 3rd level)
M. Yu, UIUC, Urbana

Welcome party
7:00-9:00 p.m. at the Westin hotel
Tyler Davidson Room 2nd floor
8:00 - 8:10 a.m.:
Welcome address:
Conference General Chair: Cliff Lau
Institute for Defense Analyses
(Presidential Room I, 3rd level)

Session Chair: Supriyo Bandyopadhyay
Virginia Commonwealth University

8:10 - 9:00 a.m.:
Keynote Speaker:
John Fenn, 2002 Nobel Laureate in Chemistry
Chemistry Department, Virginia Commonwealth University
"Electrospray Wings For Nanoscale Elephants"
(Presidential Room I, 3rd level)

9:00 - 9:45 a.m.:
Plenary Speaker:
David Miller
Stanford University
"Nanostructured optics and optoelectronics for dense interconnects"
(Presidential Room I, 3rd level)

10:00 a.m. - 12:20 p.m.
Morning Symposia

S1: Symposium on Nanoelectronics and Nanodevices (Part I)
(Presidential Room I, 3rd level)
Session Chair: Mark Lundstrom
Purdue University
Session Co-Chair: Stephen Goodnick
University Arizona State

10:00-10:30 Invited
Semiconductor Device Scaling: Physics, Transport, and the Role of Nanowires
D. K. Ferry, R. Akis, A. Cummings, M. J. Gilbert, S. M. Ramey

10:30-10:45
Towards a Theory of Single Molecule Conduction
A. W. Ghosh, B. Muralidharan, G-C. Liang, S. Datta

10:45-11:00
Inas Nanowire Transistors Using Solution-grown Nanowires with Acceptor Doping
Qingling Hang, David B. Janes, Fudong Wang, William E. Buhro

11:00-11:20: Coffee Break

11:20-11:35
Influence of Dopant Concentration on the Electrical Transport at Low Temperature in Silicon Nanowires
I. Ionica, L. Montès, J. Zimmermann, I. Ionica, L. Saminadayar, V. Bouchiat

11:35-11:50
Determination of Surface Depletion Thickness of p-Doped Silicon Nanowires Synthesized Using Metal Catalyzed CVD Process
Ibrahim Kimukin, Long Do, M. Saif Islam, A. F. M. Anwar

11:50-12:05
Power Delivery for Nanoscale Processors with Single Wall Carbon Nanotube Interconnects
Mark Budnik, Arijit Raychowdhury, Kaushik Roy

12:05-12:20
Efficient Simulation of Subwavelength Plasmonic Waveguides Using Implicitly Restarted Arnoldi
Amir Hosseini, Arthur Nieuwoudt, Yehia Massoud

S2: Symposium on Nano-optics, Nano-Photonics and Nano-optoelectronics
Part I: Nano-Optics, Nano-optoelectronics, quantum dots and nanowires
(Taft Ballroom, Section I, 3rd level)
Session Chair: John O’Brien
University of Southern California
Session Co-Chair: David Miller
Stanford University

10:00-10:30: Invited
High-Speed Quantum Dot Lasers and Amplifiers for Optical Data Communication
Matthias Kuntz, Gerrit Fiol, Carola Szewc, Matthias Lämmlin, Christian Meuer, Dieter Bimberg, Alexey Kovsh, Nikolai Ledentsov, Sebastian Ferber, Colja Schubert, Alexander Jacob, Andreas Steffan, Andreas Ummack

10:30-10:45
Selective-area Growth of the Hexagonal Nanopillars with Single InGaAs/GaAs Quantum Well and Their Temperature-dependence Photoluminescence
L. Yang, J. Motohisa, J. Takeda, K. Tomioka, T. Fukui
10:45-11:00
**Electroluminescence from Annealed ZnO Nanowires**
R. Könenkamp, R. Word, M. Godinez, A. Nadarajah

11:00-11:20: Coffee Break

11:20-11:35
**Resolving Excitonic and Free Carriers Transitions in Single-wall Carbon Nanotubes Using Field-enhanced Photocurrent Spectroscopy**

11:35-11:50
**Analysis of Photoelectronic Response in Semiconductor Nanowires**
Lingquan Wang, Peter Asbeck

11:50-12:05
**Structural and Optical Properties of Axial and Radial Heterostructure III-V Nanowires Grown by Metalorganic Chemical Vapour Deposition**
Hannah J. Joyce, Y. Kim, Q. Gao, H. H. Tan, C. Jagadish

12:05-12:20
**Accuracy of Single Quantum Dot Registration using Cryogenic Laser Photolithography**

S3: Symposium on Nanofabrication, Nanolithography, Nanomanipulation, and Nanoimaging (Part I)
(Taft Ballroom, Section II, 3rd level)
*Session Chair: Chang Liu*
*University of Illinois - Urbana Champaign*
*Session Co-Chair: David Janes*
*Purdue University*

10:00-10:30 Invited
**Single Molecule Substrates for Lithography**
Michael Norton, David Neff, Scott Day, Zachary Grambos, Mikala Shremshock, Heather Butts, Huan Cao

10:30-10:45
**Polymer Coatings on Nano-structured Semiconductor Surfaces**
Robert C. Word, R. Könenkamp

10:45-11:00
**DNA-Templated Free-standing Nanowires with Controllable Dimensions for In-situ TEM Analysis**
S. Mani, J. Han, T. Saif, G. Richter, E. Arzt

11:00-11:20 Coffee Break

11:20-11:35
**Nanofabrication of Carbon Nanotubes Assisted with Oxygen Gas**
Pou Liu, Fumihito Arai, Toshio Fukuda

11:35-11:50
**A CMOS Sensor for Nano-imaging**
Shengdong Li, Stuart Kleinfeld, Liang Jin, Nguyen H. Xuong

11:50-12:05
**Experimental and Numerical Results for an Aberrationcorrected Photoemission Electron Microscope**

S4: Symposium on Nano-sensors and Nano-membranes (Part I)
(Tyler Davidson Room, Section I, 2nd level)
*Session Chair: Aristides A.G. Requicha*
*UCLA*
*Session Co-Chair: Gary Tepper*
*Virginia Commonwealth University*

10:00-10:30 Invited
**Carbon Nanotube Array Immunosensor Development**
Adam Bange, H. Brian Halsall, William R. Heineman, YeoHeung Yun, Mark J. Schulz, Vesselin Shanov

10:30-10:45
**Three-dimensional Nano Temperature Sensors: Fabricated Using Focused Ion Beam Chemical Vapour Deposition**
Halitham M. Magdy El-Shimy, Fumihito Arai, Toshio Fukuda

10:45-11:00
**Viscous Damping of Nanoscale Resonators for Gas Composition Analysis**
Yang Xu, J-T. Lin, Bruce W. Alphenaar, Robert S. Keynton

11:00-11:20 Coffee Break
11:20-11:35  
**Nanoporous Pd Film Sensors for Detection of High Concentration Hydrogen**  
Dongyan Ding, Zhi Chen

11:35-11:50  
**A New Air Sampler Based on Electrically Charged Liquid Nanodroplets**  
Gary Tepper, John Fenn

11:50-12:05  
**Fabrication of Functional Nanofibrous Ammonia Sensor**  
Anantha Iyengar Gopalan, Kwang-Pill Lee, Kalayil Manian Pillai Manian, Padmanabhan Santhosh, Kap-Duk Song, Duk-Dong Lee

12:05-12:20  
**Sensing of Bacillus Subtilis Spores with Peptide Functionalized Microcantilevers**  
Babita Dhayal, R. Reifenberger, Walter A. Henne, Derek D. Doornneweerd, Philip S. Low

**S5: Symposium on Nanocarbon, Nanodiamond, and Carbon Nanotube based technologies**

Part I: Synthesis and Characterization of carbon nanotubes and carbon nanostructured materials  
(Tyler Davidson Room, Section II, 2nd level)  
**Session Chair:** Bruce Alphenaar  
University of Louisville  
**Session Co-Chair:** Vesselin Shanov  
University of Cincinnati

11:00-11:20 Coffee Break

11:00-11:15  
**The Potential of Nanostructured Carbons as High Efficiency, High Temperature Thermoelectric Materials for Power Generation**  
Dieter M. Gruen

11:15-11:30  
**Electrowetting on Arrayed Carbon Nanofibers**  

11:30-11:45  
**Substrate and Process Interplay during Synthesis of Millimeter-long, Multi-Wall Carbon Nanotube Arrays**  
Vesselin N. Shanov, YeoHeung Yun, Yi Tu, Mark J. Schulz

11:45-11:50  
**Disorder Induced Bands in First Order Raman Spectra of Carbon Nanowalls**  
Haomin Wang, Yihong Wu, Catherine Kai Shin Choong, Jun Zhang, Kie Leong Teo, Zhenhua Ni, Zexiang Shen

11:50-12:05  
**Temperature Driven Transport of Gold Nanoparticles Physisorbed inside Carbon Nanotubes**  
P.A.E. Schoen, D. Poulikakos, J. H. Walther, P. Koumoutsakos

12:05-12:20  
**Structural and Optical Investigation of Copper Nanoparticle and Microfiber Produced by Using Carbon Nanotube as Templates**  
Zhe Chuan Feng, Bin Xue, Ping Chen, Jianyi Lin, Weijie Lu

**Lunch Break: 12.20-2.00 p.m**
2:00-4:50 p.m.
Afternoon symposia

S1: Symposium on Nanoelectronics and Nanodevices (Part II)
(Presidential Room I, 3rd level)
Session Chair: David Ferry
Arizona State University
Session Co-Chair: Paolo Lugli
Technical University of Munich

2:00-2:30 Invited
NEMO 3D and NanoHUB: Bridging Research and Education
Gerhard Klimeck, Michael McLennan, Matteo Mannino, Marek Korkusinski, Clemens Heitzinger, Rick Kennell, Steven Clark

2:30-2:45
ZnO Nanowire Field-effect Transistors: Ozone-induced Threshold Voltage Shift and Multiple Nanowire Effect
Sanghyun Ju, Kangho Lee, David B. Janes

2:45-3:00
Single-crystalline ZnO Nanowires Grown on Silicon Wafers
R. Könenkamp, R. Word, M. Dosmailov

3:00-3:20 Coffee Break

3:20-3:35
Ultraviolet Photoresponse of ZnO Tetrapod Nanocrystal Schottky Diodes
Marcus C. Newton, Paul A. Warburton, Steven Firth

3:35-3:50
A New Approach for Establishing Electrical Contacts to a Nanowire Array as Applied to Gas Sensing
Prahalad M. Parthangal, Michael R. Zachariah, Richard E. Cavicchi

3:50-4:05
Chemically-functionalized Multi-walled Carbon Nanotube Sensors for Ultra-Low-Power Alcohol Vapor Detection
Mandy L. Y. Sin, Gary C. T. Chow, Wen J. Li, Philip Leong, M. K. Wong, K. W. Wong, Terry Lee

4:05-4:20
Single-walled Carbon Nanotubes for a Strain-based Magnetometer
Stephanie A. Getty, Gunther Kletetschka

S2: Symposium on Nano-optics, Nano-Photonics and Nano-optoelectronics
Part II: Nano-Photonics and Photonic Crystals
(Taft Ballroom, Section I, 3rd level)
Session Chair: Matthias Kuntz
Technical University of Berlin
Session Co-Chair: Chennupati Jagadish
Australian National University

2:00-2:30 Invited
Photonic Crystal Devices
John O’Brien, Min-Hsiung Shih, Tian Yang, Mahmoud Bagheri, W. K. Marshall, P. Daniel Dapkus, D. G. Deppe

2:30-2:45
Design and Simulation of an Agile, Fast and Broad-angle Electronically Tunable Beam Steerer Based on Cascaded Photonic Crystals
Hua Tan, David Klotzkin

2:45-3:00
Modeling and Fabrication of a Photonic Crystal-based Wavelength Demultiplexer
Meron Y. Tekeste, Jan M. Yarrison-Rice

3:00-3:20 Coffee Break

3:20-3:35
Optimization of Grating Coupler Efficiency for Nanophotonic Device Integration
Scott A. Masturzo, Jan M. Yarrison-Rice, Howard E. Jackson, Joseph T. Boyd

3:35-3:50
A Novel Avalanche-free Single Photon Detector

3:50-4:05
Two Color Squared-lattice Plasmonic Thermal Emitter
Ming-Wei Tsai, Tzu-Hung Chuang, Yi-Tsung Chang, Si-Chen Lee

4:05-4:20
Ultra High Speed Submonolayer Quantum-Dot Vertical-cavity Surface-emitting Lasers
F. Hopfer, A. Mutig, G. Fiol, M. Kuntz, D. Bimberg
S3: Symposium on Nanofabrication, Nanolithography, Nanomanipulation, and Nanoimaging (Part II)
(Taft Ballroom, Section II, 3rd level)
Session Chair: David Janes
Purdue University
Session Co-Chair: TBD

2:00-2:30 Invited
Multifunctional Probe Array and Local Vapor Inking Chip for Scanning Probe Nanolithography
Shifeng Li, Chang Liu, Xuefeng Wang

2:30-2:45
Controlling Formation of Nanodots and Nanocavities Using Scanning Tunneling Microscope
Violeta Iancu, Aparna Deshpande, Saw-Wai Hla

2:45-3:00
Mechanical Manipulation of Hexagonal Phase Boron Nitride Nanowires on the Silicon Substrate Utilizing Atomic Force Microscope
Jung-Hui Hsu, Shuo-Hung Chang

3:00-3:20 Coffee Break

3:20-3:35
Atomistic Constructions by using Scanning Tunneling Microscope Tip
Aparna Deshpande, Kendal Clark, Danda Acharya, Joel Vaughn, Kai-Felix Braun, Saw-Wai Hla

3:35-3:50
Nanotube Suspension Bridges Directly Fabricated from Nanotube-polymer Suspensions by Manual Brushing
Santosh Pabba, Scott M. Berry, Mehdi M. Yazdapanah, Robert S. Keyston, Robert W. Cohn

3:50-4:05
Simulation of Nanoscale Round-Top-Gate Bulk FinFETs with Optimal Geometry Aspect Ratio
Yiming Li, Wei-Hsin Chen

4:05-4:20
Development of Single Ion Implantation Technology for Nanodevice Construction
Changyi Yang

S4: Symposium on Nano-sensors and Nano-membranes (Part II)
(Tyler Davidson Room, Section I, 2nd level)
Chair: Ron Reinfenberger, Purdue University
Co-Chair: Adam Bange, University of Cincinnati

2:00-2:15
Single-carbon Nanotube-based Ion Sensor for Gas Detection
Jiangbo Zhang, Ning Xi, Hoyin Chan, Guangyong Li

2:15-2:30
Design and Testing of a Wireless Portable Carbon Nanotube-based Chemical Sensor System
James Calusdian, Xiaoping Yun, Jing Li, Yijiang Lu, Meyya Meyyappan

2:30-2:45
Development of CNT-based Sensor Array on a MUMPs Chip
King W. C. Lai, Ning Xi, Wen J. Li, C. P. Kwong

2:45-3:00
Parylene C Embedded CNT-based MEMS Piezoresistive Pressure Sensors Using DEP Nanoassembly
Maggie Q. H. Zhang, Carmen K. M. Fung, Gary C. T. Chow, Wen J. Li, Philip Leong

3:00-3:20 Coffee Break

3:20-3:35
Evaluation of Fluid Flow Through Micromachined Nanoporous Membranes using a Custom-built Automated Testing and Data Acquisition System
Ross A. Smith, Christian A. Zorman, Aaron J. Fleischman, Shuvo Roy

3:35-3:50
Synthesis and Characterization of Cu/CoFe2O4 Magnetic Nanocomposite for RFIC Application
Tzu Yuan Chao, Y. T. Cheng

3:50-4:05
Current-block Nanoelectrode Array for Label-free Detection of Proteins and Short DNA Strands
Jianchun Dong, Robert G. Egbert, Babak A. Parviz
TECHNICAL PROGRAM  Tuesday Afternoon July 18, 2006

S5: Symposium on Nanocarbon, Nanodiamond, and Carbon Nanotube based technologies
Part II: Devices and Arrays for VLSI applications
(Tyler Davidson Room, Section II, 2nd level)
Session Chair: Dieter Gruen
Argonne National Laboratory
Session Co-chair: Mark Schulz
University of Cincinnati

2:00-2:15
Temperature Limited Transport Performances of Metallic Single walled Nanotubes
Marcelo A. Kuroda, Jean-Pierre Leburton

2:15-2:30
Effects of Electrode Contact on Transport Properties of Carbon Nanotubes
Nobuhiko Kobayashi, Taisuke Ozaki, Kenji Hirose

2:30-2:45
Schottky-Barrier Carbon Nanotube Field Effect Transistor Modeling
Arash Hazeghi, Tejas Krishnamohan, H.-S. Philip Wong

2:45-3:00
Sensitivity Analysis of Wave Propagation on a Single-walled Carbon Nanotube
M. D’Amore, M. S. Sarto, A. Tamburrano

3:00-3:20 Coffee Break

3:20-3:35
Realization of a Carbon Nanotube-based Triode

3:35-3:50
Nanoassembly and Packaging of Single-carbon, Nanotube-based Transistors
Ho-Yin Chan, Ning Xi, Jiangbo Zhang, Guangyong Li

3:50-4:05
Scalable Modeling of Magnetic Inductance in Carbon Nanotube Bundles for VLSI Interconnect
Yehia Massoud, Arthur Nieuwoudt

4:05-4:20
A Novel Dual-walled CNT Bus Architecture with Reduced Cross-coupling Features
Daniele Rossi, Jos M. Cazeaux, Cecilia Metra, Fabrizio Lombardi

4:20-4:35
Integration and Electrical Properties of Carbon Nanotube Array for Interconnect Applications
Young-Moon Choi, Sunwoo Lee, Hong Sik Yoon, Moon-Sook Lee, Hajin Kim, Intaek Han, Yoonho Son, In-Seok Yeo, U-In Chung, Joo-Tae Moon

4:35-4:50
Measurability Issues in the Radio-Frequency Characterization of Carbon Nanotubes
Gael F. Close, H.-S. Philip Wong

Tuesday Evening: July 18, 2006

Poster Session
7:30-9:30 p.m.
(Residential Room, Section III, 3rd level)
Session Chair: Evelyn Hirt
Pacific Northwest Laboratory
Session Co-Chair: Savas Kaya
Ohio University
(Presidential Room I, 3rd level)
Chair: Chennupati Jagadish, Australian National University

8:15 - 9:00 a.m.:
Plenary Speaker:
T. C. Chen, IBM T.J. Watson Research Center
"Mega-Challenges for Nano-Silicon Technology".

9:00 - 9:45 a.m.:
Plenary Speaker:
Wei Lu (University of Michigan, Ann Arbor) for Prof. Charles Lieber, Harvard University
"Nanowires for Nanoscience and Nanotechnology".

10:00 a.m. - 12:20 p.m.
S3: Symposium on Nanofabrication, Nanolithography, Nanomanipulation, and Nanoimaging Part II
(Taft Ballroom, Section II, 3rd level)
Session Chair: Hank Smith
MIT
Session Co-Chair: Philip Wong,
Stanford University

10:00-10:15
High-throughput Fabrication of Nanoelectrodes on Polymer using Nanoinjection and Trench-filling Techniques
Michael J. Rust, Jaephil Do, Se Hwan Lee,
Chong H. Ahn

10:15-10:30
Fabrication of Periodic Nanostructure in Nanoimprint Process
Fuh-Yu Chang, Hung-Yi Lin, Chun-Hway Hsueh,
Shuo-Hung Chang, Tung-Chuan Wu

10:30-10:45
Pattern Generation by Using Multi-step Room-temperature Nanoimprint Lithography
S. Harrer, J. K. W. Yang, K. K. Berggren

10:45-11:00
Three-Dimensional Metal Patterning over Nanostructures by Reversal Imprint
C. Peng, S. W. Pang

11:00-11:20 Coffee Break

11:20-11:35
Fabricating Nanoscale Device Features Using the Two-step NERIME Nanolithography Process
S. F. Gilmartin, D. Collins, K. Arshak, O. Korostynska, A. Arshak

11:35-11:50
A Study of Self-assembled Mono-layer Deposition Process for the Anti-adhesion of Nano-imprint Stamps
Kuan-Wei Chen, Hung-Yi Lin, Fuh-Yu Chang, Shuo-Hung Chan, Tung-Chuan Wu, Jen-Fin Lin

S6: Symposium on Modeling and Simulation
(Presidential Room, Section III, 3rd level)
Session Chair: Jean-Pierre Leburton,
University of Illinois, Urbana-Champaign
Session Co-Chair: Gerhard Klimeck,
Purdue University

10:00-10:15
Modeling and Simulation of Nanoscale Self-Assembly Structures
Ramana M. Pidaparti, David Primeaux,
Brandon Saunders

10:15-10:30
A Coupled Simulation and Optimization Approach to Nanodevice Fabrication with Minimization of Electrical Characteristics Fluctuation
Yiming Li, Shao-Ming Yu, Cheng-Kai Chen

10:30-10:45
A Study of the Performance of Ballistic Nanoscale MOSFETS Using Classical and Quantum Ballistic Transport Models
Amr A. Ahmadain, Kenneth P. Roenker,
Karen A. Tomko

10:45-11:00
Electronic Properties of Silicon Nanowires: Confined Phonons and Surface Roughness
E. B. Ramayya, I. Knezevic, D. Vasileska,
S. M. Goodnick

11:00-11:20 Coffee Break

11:20-11:35
An Efficient and Symbolic Model for Charge Densities in Ballistic Carbon Nanotube FETs
Hamidreza Hashempour, Fabrizio Lombardi
11:35-11:50
Information Acquisition at the Nanoscale:
Fundamental Considerations
Neal G. Anderson

11:50-12:05
Bayesian Macromodeling for Circuit Level
QCA Design
Saket Srivastava, Sanjukta Bhanja

12:05-12:20
A Novel Design and Simulation of Resonant
Cavity Enhanced (RCE) Corrugated Quantum
Well Infrared Photodetectors (C-QWIP) Using
the Finite Difference Time Domain (FDTD)
Method
Jang Pyo Kim, Andrew M. Sarangan

S7: Symposium on System integration
(Nano/Micro/Macro), NEMS, and
Actuators
(Taft Ballroom, Section I, 3rd level)
Session Chair: Chong Ahn
University of Cincinnati
Session Co-Chair: T. Fukuda
Nagoya University

10:00-10:30 Invited
Synthetic Molecular Machines
Marina Alexandra Lyshevski

10:30-10:45
Growth and Hydrogen Sensing Properties of
Carbon Nanotubes Using an MEMS Approach
Wei Wei, Mark Bachman, G. P. Li

10:45-11:00
Fabrication of an Insulated Probe on a
Self-assembled Metallic Nanowire for
Electrochemical Probing in Cells
A. Safir, M. M. Yazdanpanah, S. Pabba, S. D. Cambron,
F. P. Zamborini, R. S. Keynton, R. W. Cohn

11:00-11:20 Coffee Break

11:20-11:35
Shell Engineering of Carbon Nanotube Arrays
by Current Driven Breakdown
Arunkumar Subramanian, Lixin Dong, Dominic
Frutiger, Bradley J. Nelson

11:35-11:50
A Suspended Au Nanowire Bridge with
Functionalized Self-assembled Monolayers
(SAMs)
Zhiwei Zou, Junhai Kai, Chong H. Ahn

11:50-12:05
Design of a 6DOF, Stewart-type Nanoscale
Platform
Yung Ting, Ho-Chin Jar, Chun-Chung Li

12:05-12:20
The Implementation of a Novel Magnified
Cascade Configuration Using a Vertical
Electrostatic Actuator
J. C. Chiou, C. F. Kuo, Y. J. Lin

12:20-12:35
Electroactive Polymer Actuation at the
Nanoscale
Alexander S. Lee, James V. Ly, Serban F. Peteu,
Mark E. Thompson, Chongwu Zhou, Aristides A. G.
Requicha

S5: Symposium on Nanocarbon,
Nanodiamond, and Carbon Nanotube
based technologies
Part III: Applications of carbon nanotubes:
processing and characterization of materials
and devices
(Tyler Davidson Room, Section II, 2nd level)
Session Chair: Bruce Alphenaar
University of Louisville
Session Co-Chair: Yonhua Tzeng
Auburn University

10:00-10:15
Mechanical Properties of Double
Coiled-carbon Nanotubes
Neng-Kai Chang, Shuo-Hung Chang

10:15-10:30
Carbon Nanotube Soldering with Gold Nanoink
by the Fountain-Pen Technique
Cedric P. R. Dockendorf, Markus Steinlin,
Tae-Youl Choi, Dimos Poulvakos

10:30-10:45
Temperature-dependent Characteristics of
Carbon Nanofiber Arrays
Quoc Ngo, Yusuke Ominami, Alan M. Cassell, Jun Li,
M. Meyyappan, Cary Y. Yang
10:45-11:00  
**Fabrication and Characterization of a Multiwall Carbon Nanotube Needle Biosensor**  
YeoHeung Yuna, Adam Bangeb, Vesselin N. Shanovc, William R. Heinemanb, H. Brian Halsallb, Zhongyun Dongd, Abdul Zajiehed, Yi Tue, Danny Wongf, Sarah Pixleyd, Michael Behbehand, Mark J. Schulzd

11:00-11:20 Coffee Break

11:20-11:35  
**Assessment of Influence of Finely Dispersed Carbon Nanotubes in Polymer Electrolytes for Lithium Batteries**  
Kwang-Pill Lee, Anantha Iyengar Gopalan, Kalayil Manian Pillai Manian, Padmanabhan Santhosh, Kim Kyu Soo

11:35-11:50  
**Accurate Resistance Modeling for Carbon Nanotube Bundles in VLSI Interconnect**  
Yehia Massoud, Arthur Nieuwoudt

11:50-12:05  
**Tunnel Gap Modulation Spectroscopy: A Scanning Probe High Frequency Nanoscale Oscillator**  
L. Biedermann, C. Lan, R. Reifenberger, J. Therrien

12:05-12:20  
**Single-walled Carbon Nanotube Junctions for Nano-Electronics and Sensors**  
Sarah Lastella, Govind Mallick, Shashi P. Karnam, Yung Joon, Chang Ryu, Pulickel Ajayan

S9: Symposium on Spintronics, Nanomagnetics, and Quantum Computing  
Part I: Spin injection, transport and relaxation  
(Tyler Davidson Room, Section I, 2nd level)  
**Session Chair:** Vladimir Privman  
Clarkson University  
**Session Co-Chair:** Harold Grubin  
University of Connecticut

10:00-10:30 Invited  
**Nanoimprint Technology for Three Dimensional Microsystems**  
S. W. Pang

10:30-10:45  
**Molecular Electronics–From Structure to Circuit Dynamics**  
Yuhui Lu, Mo Liu, Craig Lent
10:30-10:45
Influence of Impurity Scattering on Spin Injection Efficiency at a Ferromagnet/Semiconductor Interface
J. Wan, M. Cahay, S. Bandyopadhyay

10:45-11:00
Spin-polarized Electron Transport via a C60 Molecule
Haiying He, Ravindra Pandey, Shashi P. Karna

11:00-11:20 Coffee Break

11:20-11:35
An All Electrical Spin Detector
Sayeef Salahuddin, Supriyo Datta

11:35-11:50
Spin Polarization Control in Two-dimensional Electron Systems: Enhanced Zeeman Splitting and Spin-Orbit Interaction Effects
Anh T. Ngo, J. M. Villas-Bôas, S. E. Ulloa

11:50-12:05
Circuit Models for Small Signal Performance of Spin 1/2 Quantum Systems
Pier Paolo Civalleri, Marco Gilli, Michele Bonnin

12:05-12:20
Transverse Spin Relaxation Times in an Ensemble of Electrochemically Self-assembled CdS Quantum Dots
S. Pramanik, B. Kanchibotla, S. Bandyopadhyay

12:20-2:00 p.m Lunch Break

Wednesday afternoon, July 19, 2006:
12:00-6:00 p.m.
Choice of 7 Excursions

Rump Session on Funding Opportunities:
6:00-7:00 p.m.
(Presidential Room, Section III, 3rd level)
Moderator: Cliff Lau
Institute for Defense Analyses

Wednesday Evening:
Dinner + Entertainment at the Westin Hotel:
7:00-10:00 p.m.
Presidential Room, Sections I + II, 3rd level
Attraction: Blue Grass Band
8:15 - 9:00 a.m.:
Plenary Speaker:
Jerry Woodall, Purdue University
"QDs and Nanowires: What about surface Fermi level pinning?".

9:00 - 9:45 a.m.:
Plenary Speaker:
Hank Smith, MIT
"The key role of flexible, low-cost, maskless lithography in nanoscale science and engineering".

10:00 a.m. - 12.20 p.m.
Morning Symposia

S9: Symposium on Spintronics, Nanomagnetics, and Quantum Computing
Part II: Nanomagnetics and Quantum Control
(Tyler Davidson Room, Section I, 2nd level)
Session Chair: Jean-Pierre Leburton
Univ. of Illinois, Urbana-Champaign
Session Co-Chair: Vladimir Privman
Clarkson University

10:00-10:30 Invited
Magnetic Resonance Coupled with Electric and Spin Currents in NiFe Nanostructures
E. Saitoh

10:30-10:45
High-frequency, Domain-wall Motion and Magnetization Rotation of Patterned Permalloy Films under External Magnetic Field Excitation
Syed Azemuddin, Axel Hoffmann, Ralu Divan, Michael J. Donahue, Seok Hwan Chung, Pingshan Wang

10:45-11:00
The Advantages of Magnetic Field Control of Charge within Diluted Magnetic Semiconductor Superlattices
H. L. Grubin

11:20-11:35
Enhancing Dependability through Quantum Entanglement in a Real-Time Distributed System
Yao-Hsin Chou, I-Ming Tsai, Sy-Yen Kuo

11:35-11:50
Quantum Authentication and Secure Communication Protocols
Tien-Sheng Lin, I-Ming Tsai, Han-Wai Wang, Sy-Yen Kuo, Tien-Sheng Lin

S8: Symposium on Molecular Electronics, Inorganic Nanowires, Nanocrystals, and Quantum Dots
Part II: Plasmonics and Nanoenabled Devices
(Presidential Room I, 3rd level)
Session Chair: Chennupati Jagadish
Australian National University
Session Co-Chair: Jason Heikenfeld
University of Cincinnati

10:00-10:30 Invited
Large-Area Nanophotonics Fabricated by Interferometric Lithography
S. R. J. Brueck

10:30-10:45
Dielectric Response of a Planar Periodic Array of Polarizable Wires Parallel to an Interface with a Nonlocal Dynamic Plasma-like Medium
Norman J. M. Horing, L. Y. Chen, H. L. Cui

10:45-11:00
Engineering Tunnel Barriers in Hybrid Silicon/Molecular Memory Devices
Srivardhan Gowda, Guru Mathur, Veena Misra

11:00-11:20 Coffee Break

11:20-11:35
Second Order Nonlinear Dielectric Response of a Dynamic, Nonlocal Plasma Subject to Terahertz Radiation
Norman J. M. Horing, S. Y. Liu, H. L. Cui

11:35-11:50
Structural and Optical Characterization of InAs/GaSb Nanoscale Superlattices for Mid-Infrared Detection
J. B. Rodriguez, E. Plis, S. J. Lee, L. R. Dawson, S. Krishna
11:50-12:05
Substrate and Dipole Effects in Metal-Molecule-Semiconductor Heterostructures
Patrick Carpenter, Adina Scott, Saurabh Lodha, David Janes, Chad Risko, Mark Ratner

S10: Symposium on Nano-bio fusion, nano-biology, nano-bio-medical science
Part I: “Mostly” Micro/Nano Structures
(Taft Ballroom, Section I, 3rd level)
Session Chair: Andrew Steckl
University of Cincinnati
Session Co-Chair: Mitra Dutta
UIUC-Chicago

10:00-10:30 Invited
Integrating Manmade Nanostructures with Biological Structures
Michael A. Stroscio, Mitra Dutta

10:30-11:00 Invited
Engineering and Fabricating a Hybrid Biotic/Abiotic Biological Computer
Carlo D. Montemagno

11:00-11:20 Coffee Break

11:20-11:35
Superparamagnetic Resonance of de novo Biomagnetic Nanoparticles
Larisa Radu, Daniella Caruntu, Michelle White, Charles J. O’Connor, John Wiley, Paul Hanson

11:35-11:50
Core-Shell Nanocomposites for Real Time Detection and Capture of Pathogens
Shalyajit Jadhav, Suri Iyer

11:50-12:05
Dynamic Modeling and Control of a Micro-needle Integrated Piezoelectric Micro-pump for Diabetes Care
Ruoting Yang, Mingjun Zhang, Tyzh-Jong Tarn

12:05-12:20
Reconstruction of Cellular Processes in Nanoscale Artificial Organelles: Solvent-free Incorporation of Proteins into Block Copolymers
Hyo-Jick Choi, Carlo D. Montemagno

12:20-12:35
Modeling of Binding Sites and Electrostatics in the Ion-Motive Sodium Pump
J. Fonseca, S. Kaya, R. Rakowski

S11: Symposium on Nanocircuits and Architectures: Manufacturing issues and reliability
(Tyler Davidson Room, Section II, 2nd level)
Session Chair: Jose Fortes
University of Florida-Gainesville
Session Co-Chair: Pinaki Mazumder
University of Michigan

10:00-10:15
A Nanoscale Memory Interface Scheme Based on Hierarchical Memory Mapping
Girish Venkatasubramanian, Renato J. Figueiredo

10:15-10:30
A Nano-Scale Crossbar with Spin Waves
Mary M. Eshghian-Wilner, Alexander Khitun, Shiva Navab, Kang L. Wang

10:30-10.45
Dual-phase Line-based QCA Memory Design
Baris Taskin, Bo Hong

10:45-11:00
Nanoelectronic Circuits for Stochastic Computing
Naoya Yamamoto, Hisato Fujisaka, Kazuhisa Haeiwa, Takeshi Kamio

11:00-11:20 Coffee Break

11:20-11:35
On Practical Multiplexing Issues
Valeriu Beiu, Mawahib H. Sulieman

11:35-11:50
Novel Architecture Based on Floating Gate CNT-NEMS Switches and Its Application to 3D On-chip Bus beyond CMOS Architecture
Shinobu Fujita, Kumiko Nomura, Keiko Abe, Thomas H. Lee

11:50-12:05
New Velocity-tuned Filter Using Nanoelectronic Architecture
Woo Hyung Lee, Pinaki Mazumder

12:05-12:20
Using Super Cut-off Carbon Nanotube Sleep Transistors in Silicon-based Low Power Digital Circuits
Arijit Raychowdhury, Kaushik Roy
S12: Symposium on Nanomaterials and Nanostructures: Synthesis and Characterization Part I
(Taft Ballroom, Section II, 3rd level)
Session Chair: Punit Boolchand
University of Cincinnati
Session Co-chair: David Primeaux
Virginia Commonwealth University

10:00-10:15
SnO2 Nanorods Prepared by Inductively Coupled Plasma-enhanced Chemical Vapor Deposition
Y. C. Lee, O. K. Tan, H. Huang, M. S. Tse, H. W. Lau

10:15-10:30
Ge Nanowire Synthesis for Chip-specific Application
X. H. Sun, B. Yu, G. A. Calebotta, M. Meyyappan

10:30-10:45
Unusual Growth of InP Nanowires Grown on Silicon
Ibrahim Kimukin, Chad D. Johns, Christopher W. Edgar, M. Saif Islam, Sungsoo Yi

10:45-11:00
Catalyst-free Growth of Carbon Nanotubes on Nonplanar, Polycrystalline Silicon Carbide Substrates for Electrochemical and Photochemical Applications
John Boeckl, Bill L. Riehl, Mike Check, Elmo Blubaugh

11:00-11:20 Coffee Break

11:20-11:35
TEM Observation of the Giant Carbon Nanotube Construction Using Langmuir-Blodgett Films
Yoshiaki Imaizumi, Masahito Kushida, Yoichiro Arakawa, Fumihiro Arai, Toshio Fukuda

11:35-11:50
Controlled Lateral Growth of ZnO Nanowires Using a Growth Barrier
J. B.K. Law, J. T. L. Thong

11:50-12:05
Characterization of Carbonaceous Impurity Level in As-produced Single-walled Carbon Nanotubes by Using Solution-phase Spectrophotometry
Xuliang Han

12:05-12:20
Characterize the Thermal Properties of the Vertical Aligned Carbon Nanotubes Array Used for IC Cooling with Photothermal Method
Yi Zhang, Yuan Xu, Xinwei Wang

12:20-2:00 p.m. Lunch Break
S9: Symposium on Spintronics, Nanomagnetics, and Quantum Computing
Part III: Quantum Computing Architectures and Decoherence
(Tyler Davidson Room, Section I, 2nd level)
Session Chair: Harold Grubin
University of Connecticut
Session Co-Chair: Jean-Pierre Leburton
University of Illinois, Urbana-Champaign

2:00-2:30 Invited
First Principles Investigation of Electronic Structure, Magnetic Properties and Spin Polarized Conductance of Self-assembled Molecular Monolayers (SAMs) on Ni(111) Substrate
Ranjit Pati, Saroj K. Nayak

2:30-3:00 Invited
Charging Characteristics of a Few Electron Triple Lateral Quantum Dot System in GaAs/AlGaAs
Sergei Studenikin, Louis Gaudreau, Andy Sachrajda, Piotr Zawadzki, Alicia Kam, Jean Lapointe, Marek Korkusinski, Pawel Hawrylak

3:00-3:20 Coffee Break

3:20-3:35
Implementation of Three Qubit Quantum Logic Gates in Ballistic Nanowires
Angik Sarkar, Ajay Patwardhan, T. K. Bhattacharyya

3:35-3:50
Quantum Entanglement and Its Applications on Secure Computation
Yao-Hsin Chou, I-Ming Tsai, Sy-Yen Kuo

3:50-4:05
Decoherence of Dynamically-manipulated Qubits
Vladimir Privman, Dmitry Solenov

4:05-4:20
A Pedagogical Approach to Quantum Computing using Spin-1/2 Particles
Prashant, Nishchal Chaudhary

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S8: Symposium on Molecular Electronics, Inorganic Nanowires, Nanocrystals, and Quantum Dots
Part III: Nanowires and Quantum Dots
(Presidential Room I, 3rd level)
Session Chair: Michael Norton
Marshall University
Session Co-Chair: Steve Brueck
University of New Mexico

2:00-2:30 Invited
Quantum Dot-based Integrated Optoelectronic Devices
S. Mokkapati, L. Fu, H. H. Tan, C. Jagadish

2:30-2:45
Exciton Binding Energy in Semiconductor Nanowires in the Presence of Dielectric De-confinement

2:45-3:00
Molecular Beam Epitaxy of GaAs Nanowires on Si Substrates
Soo-Ghang Ihn, Jong-In Song, Young-Hun Kim, Jeong Yong Lee

3:00-3:20 Coffee Break

3:20-3:35
Imaging and Optical Properties of Single Core-shell GaAs-AlGaAs Nanowires
Thang B. Hoang, L. V. Titova, H. E. Jackson, L. M. Smith, J. M. Yarrison-Rice, Y. Kim, H. J. Joyce, C. Jagadish

3:35-3:50
Optical Properties of Stranski-Krastanow and Strain-free GaSb Quantum Dots on GaAs Substrates—Towards Sb-based Type-II Quantum Dot Emitters

3:50-4:05
Low-Temperature Optical Characterization of Single CdS Nanowires
L. V. Titova, Thang B. Hoang, H. E. Jackson, L. M. Smith, J. M. Yarrison-Rice, J. L. Lensch, L. J. Lauhon

4:05-4:20
Engineering Exchange Interaction in Coupled Elongated Quantum Dots
L.-X. Zhang, D. V. Meinkov, Jean-Pierre Leburton
4:20-4:35
Are Short Molecules Quantum Dot Arrays?
B. Muralidharan, A. W. Ghosh, S. K. Pati, S. Datta

4:20-4:35
Mechanical Testing of Hydrated Collagen Nanofibrils Using MEMS Technology
Z. Liu, B. N. Smith, H. Kahn, R. Ballarini, S. J. Eppell

S10: Symposium on Nano-bio Fusion, Nano-biology, Nano-bio-medical science
Part II: “Mostly” Micro/Nano Fluidics
(Taft Ballroom, Section I, 3rd level)
Session Chair: Mitra Dutta
UIUC-Chicago
Session Co-Chair: Andrew Steckl
University of Cincinnati

2:00-2:30 Invited Nanodevices for Biomolecular Manipulation and Analysis
H. G. Craighead

2:30-2:45
Challenges and Opportunities for Biophotonic Devices in the Liquid State and the Solid State

2:45-3:00
Integrated Microfluidic System for DNA Analysis
V. R. Dukkipati, S. W. Pang

3:00-3:20 Coffee Break

3:20-3:35
Electrophoretic Mobility of Nano-sized Actin Filaments in Biomolecular Device
Hideyo Takatsuki, Raghu Chilakamarri, Parviz Famouri, Kazuhiro Kazuhiro

3:35-3:50
Molecular Fluidic Electronics
Marina Alexandra Lyshevski

3:50-4:05
Characterization of Molecular Photovoltaic and Photosystem I Reconstituted Proteoliposomes
I. Lee, E. Greenbaum, T. Kuritz, M. Rodriguez

4:05-4:20
Device Fabrication of Active Matrix Thin Film Transistor Arrays For Intracellular Probing
S.-ik Jun, P.D. Rack, T.E. McKnight, A.V. Melechko, M.L. Simpson

2:00-2:15
ZnSe Nanorings and Its Cathodoluminescence

2:15-2:30
Synthesis, Characterization and Oxidation Effects of Solid-State Reaction Silicon Nanocrystals
H. W. Lau, O. K. Tan, Y. Liu, T. P. Chen

2:30-2:45
Low-Temperature Growth of SnO2 Nanoblades and Their Photoluminescence Properties
Yung-Chiun Her, Jer-Yau Wu, Yan-Ru Lin, Song-Yeu Tsai

2:45-3:00
Growth Mode of Coherent Si1-xGex Islands on Si(100)
D. J. Lockwood, X. Wu, J.-M. Baribeau

3:00-3:20 Coffee Break

3:20-3:35
Understanding the Growth Mechanisms of Electron Beam Induced Deposition via a Monte Carlo-based, 3D Growth Simulation
D. A. Smith, P. D. Rack, J. D. Fowlkes, Ted Liang

3:35-3:50
Thermal, Electrical Transport, and Structural Characterization of (AgI)x(AgPO3)1-x Glasses
D. I. Novita, P. Boolchand

3:50-4:05
Electrochemical Characteristics of Self Assembled Monolayers of Oligothiophenes
T. C. Deivaraj, Peter Anthony Collier, Wai Tat Kerk, Wee Shong Chin, Kian Ping Loh
1:30-5:00 p.m.:
S11: Special session on Nanocircuits and architectures: Manufacturing issues and reliability
(Tyler Davidson, Section II, 2nd level)
Moderator: Cliff Lau
Chair: Rick Kiehl, University of Minnesota
Co-Chair: Sankar Basu,
National Science Foundation

1:30-1:45 Chair’s remarks
Rick Kiehl

1:45-2:15 Invited
Order Out of Disorder: Putting Together Functional Nanoelectronic Systems
Alex Orailoglu, University of California, San Diego

2:15-2:45 Invited
Designing Circuits with Carbon Nanotubes: Open Questions and Some Possible Directions
Jie Deng, Nishant Patil, Subhasish Mitra,
H.-S. Philip Wong
Philip Wong, Stanford University

2:45-3:15 Invited
The Price of Scaling Down: Functional Density versus Disorder
Vwani Roychowdhury, University of California, Los Angeles

3:15-3:30 Coffee Break

3:30-4:00 Invited
Towards Defect-Tolerant Nanoscale Architectures
Csaba Andras Moritz, Teng Wang
Andras Moritz, University of Massuchussets

4:00-4:30 Invited
Applications of Quantum Dots in Nanoelectronics and Plasmonics
Pinaki Mazumder, University of Michigan

4:30-5:00 Invited
Nanocomputing with Probabilistic Logic
Jose Fortes, University of Florida - Gainesville
Poster Papers

Modeling and Simulation
1. Energy Analysis of QCA Circuits for Reversible Computing
   Jing Huang, Xiaojun Ma, Fabrizio Lombardi

2. Multigrid Simulation Method for Quantum Transport in Molecular Electronic Devices
   Guogang Feng, Nimal Wijesekera, Thomas L. Beck

3. Probabilistic Error Model for Unreliable Nano-logic Gates
   Thara Rejimon, Sanjukta Bhanja

4. The Role and Application of Controlled Brownian Dynamics in Neurons and Synthetic Molecular Devices
   Marina Alexandra Lyshevski

5. The RTM/NEGF Method for ab initio Calculations of Electron Transport through Nano-structures
   Kenji Hirose, Nobuhiko Kobayashi

Molecular Electronics, Inorganic Nanowires, Nanocrystals, and Quantum Dots
6. Inelastic Transport through Molecules: First-Principles Modeling and Selection Rules
   Magnus Paulsson

7. Quantizing Parallel Magnetic Field Role in Statistical Thermodynamics of a Narrow Quantum Well
   Norman J. M. Horing, Bing Dong, H. L. Cui

8. Raman Spectroscopy as a Probe of Single Semiconductor Nanowires
   A. Abdi, L.V. Titova, L. M. Smith, H.E. Jackson, J. M. Yarrison-Rice, J. L. Lensch, L. J. Lauhon

Nanobiofusion, Nanobiology, Nano-Biomedical Science
9. An AFM Method for in situ Probing Membrane Proteins under Physiological Condition
   Guangyong Li, Ning Xi, Ho-Yin Chan, Donna H. Wang

10. Effects of Rare Earth Nano Material on the Immune Function of Cavies
    Jianwei Ma, Fenglei Zhou, Yan Dong, Shaojuan Chen

11. Molecular Cognitive Information Processing and Computing Platforms
    Sergey Edward Lyshevski

12. Registration of Tapping and Contact Mode Atomic Force Microscopy Images

13. Effect of Packing on Cluster Solvation of Nanotubes
    Francisco Torrens, Gloria Castellano

    Maria Sabrina Sarto, Alessio Tamburrano

15. Industrial Production of Multiwalled Carbon Nanotubes
    Martin Schmid, Volker Michele, Ralph Weber, Aurel Wolf, Leslaw Mleczko

Nanocarbon, Nanodiamond, and Carbon Nanotube Based Technology
16. Observation of Carbon Nanotubes in Water Under Optical Microscope
    Maeto Nagai, Akio Shimizu, Fumihito Arai, Akihiko Ishijima, Toshio Fukuda
Nanocircuits and Architectures: Manufacturing Issues and Reliability

17 Characteristic Comparison of SRAM Cells with 20 nm Planar MOSFET, Omega FinFET and Nanowire FinFET
Yiming Li, Chien-Sung Lu

18 Clocking and Cell Placement for QCA
V. Vankamamidi, M. Ottavi, F. Lombardi

19 Cost-Driven Repair of a Nanowire Crossbar Architecture
Yadunandana Yellambalase, Shanrui Zhang, Minsu Choi, Nohpill Park, Fabrizio Lombardi

20 Information-Theoretic Analysis of Three-dimensional Molecular Integrated Circuits
Sergey Edward Lyshevski

21 Low-Power Tunable Analog Circuit Blocks Based on Nanoscale Dual-gate MOSFETs
Savas Kaya, Hesham F. A. Hamed, Janusz Starzyk

22 Methods and Tools for Reliability Driven Defect- and Fault-tolerant Design of Nanosystems
Debayan Bhaduri, Sandeep K. Shukla, Paul Graham, Maya Gokhale

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Wen J. LI
The Chinese University of Hong Kong
General Chair
wen@acae.cuhk.edu.hk

Ning XI
Michigan State University
General Co-Chair
xin@egr.msu.edu

Bradley J. NELSON
ETH, Zurich
Program Chair
bradley.nelson@ria.mavt.ethz.ch

Sai Peng WONG
The Chinese University of Hong Kong
Organizing Chair
spwong@ee.cuhk.edu.hk

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