

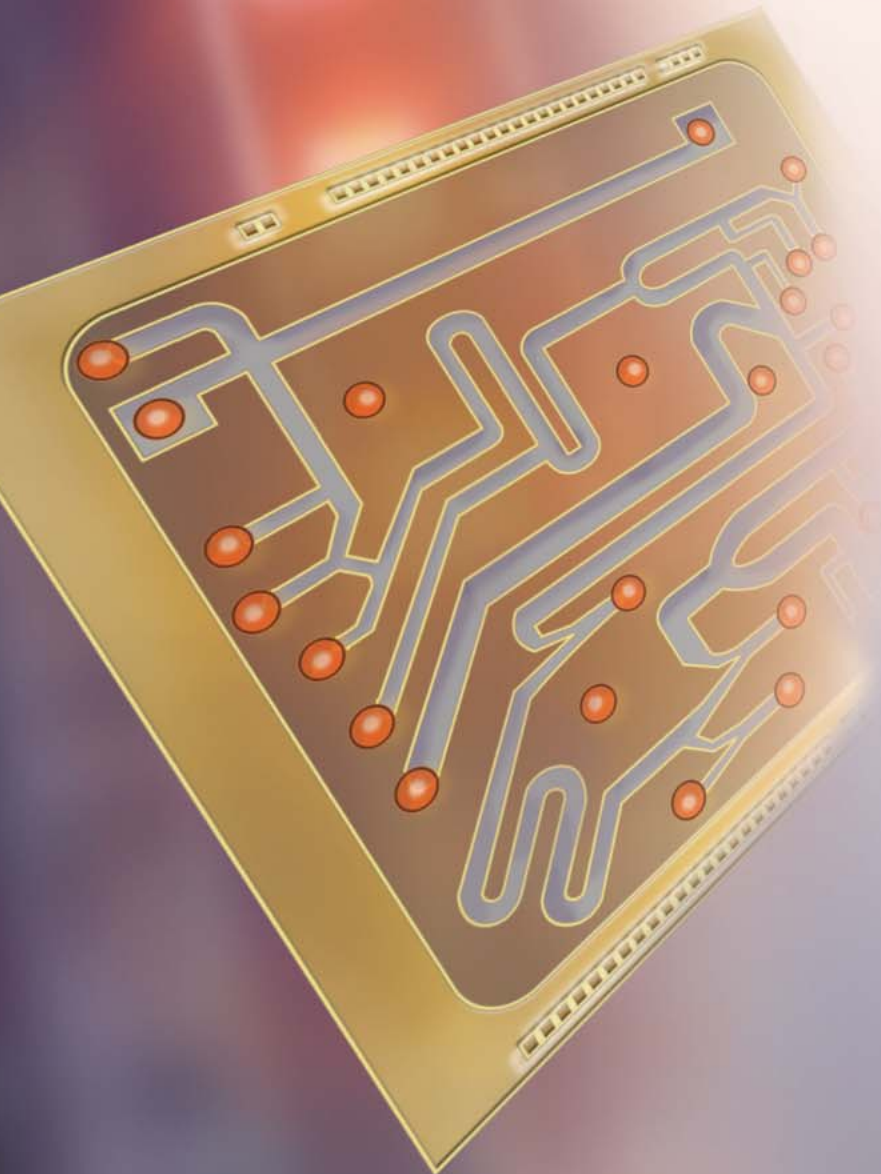
Technical Program


SPIE
OpticsEast

*Photonics for Applications in Industry,
Life Sciences, and Communications*

1–4 October 2006

Hynes Convention Center, Boston, Massachusetts USA



 The International Society
for Optical Engineering

Plenary Presentations

Communications/ITCom Plenary Presentations

Hynes Convention Center, Room 100

Monday 9:30 am to 12:00 pm

Chairs: **Achyut K. Dutta**, Banpil Photonics, Inc.; **Werner Weiershausen**, T-Systems International GmbH (Germany)

9:30 to 10:10 am

The NSF/SBIR Innovation Model



Murali S. Nair, National Science Foundation

Abstract: General information about the Small Business Innovation Research/Small Business Technology Transfer Programs at the National Science Foundation will be provided. The presentation will then describe the NSF/SBIR Innovation Model and provide key program statistics. The review criteria and the review process will then be explained.

Insight into upcoming topics areas and the development of various future solicitations, with special focus on the "Electronics" solicitation will be provided. The funding of small businesses pursuing electro-optics, photonics, MEMS, RF, Instrumentation and sensor technologies is described. Finally, commercialization strategies used by the NSF/SBIR program to help portfolio companies will be presented.

Biography: Dr. Murali S. Nair is a Program Director with the Small Business Innovation Research (SBIR) Program at the National Science Foundation (NSF). Prior to joining NSF, he was the Founder and CEO of a wireless company. In this capacity, he raised equity capital for worldwide operations in US, India, China and Brazil. He designed, planned and implemented the product development cycle, and managed the marketing strategy, strategic alliances and business development processes. Before that, Dr. Nair was a Senior Systems Engineer at L-3 Communications where he provided strategic advice to the EVP for a complete re-plan of the Hughes contract for real-time, embedded ground control software for the \$350M PANAMSAT communications satellite. Prior to joining L-3 Communications, he was a Mission Planner at Motorola Iridium where he was involved in all aspects of satellite operations including orbit determination, generating guidance targets and orbital slot placement. Before joining Iridium, Dr. Nair was a faculty member at Embry-Riddle Aeronautical University, where he developed a Space Systems Design Lab from concept inception to fully operational mode and national prominence. Dr. Nair is a registered professional engineer in the State of Florida.

Coffee Break 10:10 to 10:40 am

10:40 to 11:20 am



Prospects of Silicon Photonics for future VLSI Interconnects

Dr Mario Paniccia, Intel Corporation, Director, Photonics Technology Lab., Communications Technology Lab.

Abstract: The silicon chip has been the mainstay of the electronics industry for the last 40 years and has revolutionized the way the world operates. Today a silicon chip the size of a fingernail contains nearly one billion transistors and has the computing power that only a decade ago would take up an entire room of servers. Silicon photonics that mainly based upon silicon on insulator (SOI) has recently attracted a great deal of attention since it offers an opportunity for low cost opto-electronic solutions for applications ranging from telecommunications down to chip-to-chip interconnects.

Recent advances and research breakthroughs in silicon photonic device performance over last few years have shown that silicon can be considered as a material onto which one can build future optical devices. While significant efforts are needed to improve device performance and to "commercialize" these technologies, progress is moving at a rapid rate. If successful, silicon photonics may similarly come to dominate the optical communications as it has the electronics industry.

In this session, Dr. Paniccia will provide an overview of silicon photonics research at Intel and discuss the key building blocks needed for "siliconizing" photonics. The talk will also discuss if and how the combination of advanced CMOS electronics with photonics could be used for future optical interconnects and discuss what key challenges are needed to be addressed in order to make this transition happen. In addition the presentation will discuss some of the practical issues and challenges with processing silicon photonic devices in a high volume CMOS manufacturing environment.

Biography: **Dr. Mario Paniccia** is a Senior Principal Engineer and Director of the Photonic Technology Lab. at Intel Corporation. Mario currently directs a research group with activities in the area of Silicon Photonics. The team is focused on developing silicon-based photonic building blocks for future use in enterprise and data center communications. Mario has worked in many areas of optical technologies during his career at Intel including optical testing for leading edge microprocessors, optical communications and optical interconnects. His teams pioneering activities in silicon photonics have led to first silicon modulator with bandwidth >1GHz (2004) and the first continuous wave Silicon laser breakthrough (2005). Mario has won numerous including in November 2004 Mario was awarded by Scientific American to be one of the top 50 researchers for his teams work in the area of silicon photonics. He has published numerous papers, including 3 Nature papers, 2 book chapters, and has over 65 patents issued or pending. He is a senior member of IEEE and a fellow of OSA. Mario earned a B.S. degree in Physics in 1988 from the State University of New York at Binghamton and a Ph.D. degree in Solid State Physics from Purdue University in 1994.

11:20 am to 12:00 pm

Flexible optical transport networks: Demands and trends on new Layer 2 techniques



Gert J. Eilenberger, Alcatel SEL AG, Research & Innovation Centre

Abstract: This talk deals with potential evolution scenarios from today's networks towards long term network architectures for multi-layer transport with a novel Layer 2 transport service based on optical and opto-electronic burst/packet techniques providing the flexibility, scalability, reliability and Quality of Service to support all future higher layer services optimizing both CAPEX and OPEX. An integrated control plane on the basis of GMPLS protocols will support the mostly automatic network operation by a vertical integration of Layer 1-2-3 technologies and a horizontal integration of domains providing end-to-end control and QoS. This long term evolutionary process needs to cover as well the necessary steps in the evolution of current standards.

Biography: **Gert J. Eilenberger** is heading the unit for optical networking at the Alcatel Research & Innovation Center, Stuttgart, Germany. He holds a Dr.-Ing. degree in communication engineering from the University of Stuttgart, Germany. His main interests are on next generation multi-layer optical transport networks based on WDM and burst/packet techniques and integrated control plane concepts. He has authored many technical papers on electronic and optical broadband telecommunications and holds several patents. Since 1985, he has been involved in various national and European research projects (currently BMBF EIBONE and IST FP6 NOBEL 2).

Nanomaterial Synthesis and Integration for Sensors, Electronics, Photonics, and Electro-Optics

Conference Chairs: Nibir K. Dhar, Army Research Lab.; Achyut K. Dutta, Banpil Photonics; M. Saif Islam, Univ. of California/Davis

Program Committee: Rajeevan Amirtharajah, Univ. of California/Davis; Mehdi Anwar, Univ. of Connecticut; Jayadevan Balachandran, Tohoku Univ. (Japan); Burhan Bayraktaroglu, Air Force Research Lab.; Connie J. Chang-Hasnain, Univ. of California/Berkeley; Frederic T. Chong, Univ. of California/Santa Barbara; Yi Cui, Stanford Univ.; Nicolaas F. de Rooij, Univ. de Neuchâtel (Switzerland); Yoel Fink, Massachusetts Institute of Technology; Martina Gerken, Univ. Karlsruhe (Germany); Zhixiong Guo, Rutgers Univ.; Roland Harig, Technische Univ. Hamburg-Harburg (Germany); David A. Horsley, Univ. of California/Davis; Satoshi Kawata, Osaka Univ. (Japan); Sehun Kim, Korea Advanced Institute of Science and Technology (South Korea); Andres H. La Rosa, Portland State Univ.; Jing Li, NASA Ames Research Ctr.; Jia G. Lu, Univ. of California/Irvine; Samuel S. Mao, Lawrence Berkeley National Lab.; Gilberto Medeiros-Ribeiro, Lab. Nacional de Luz Sincrotron (Brazil); Shuming Nie, Emory Univ.; Robert Olah, Banpil Photonics, Inc.; Ekmel Özbay, Bilkent Univ. (Turkey); Sharka M. Prokes, Naval Research Lab.; Regina Ragan, Univ. of California/Irvine; Ant Ural, Univ. of Florida; Ruxandra Vidu, Q1 Nanosystems; Kang L. Wang, Univ. of California/Los Angeles; Zhong Lin Wang, Georgia Institute of Technology; Richard T. Webster, Air Force Research Lab.; Cary Y. Yang, Santa Clara Univ.; Sungsoo Yi, Lumileds Lighting, LLC; Yuegang Zhang, Intel Corp.; Chongwu Zhou, Univ. of Southern California

Sunday 1 October

SESSION 1

Hynes Conv. Ctr. Room 102 Sun. 10:30 am to 12:00 pm

Synthesis, Organization, and Incorporation of Nano-Structures I

Chairs: Sharka M. Prokes, Naval Research Lab.;
Shashi P. Karna, U.S. Army Research Lab.

10:30 am: **Transport, assembly, and rotation of nanowires in suspension**, D. Fan, F. Q. Zhu, R. C. Cammarata, C. Chein, Johns Hopkins Univ. . [6370-01]

10:45 am: **A nanotube-on-insulator (NOI) approach toward scalable and integratable nanotube devices on sapphire**, C. Zhou, Univ. of Southern California [6370-02]

11:00 am: **Luminescent quantum dots for cellular analysis (Invited Paper)**, Z. Rosenzweig, L. Shi, N. Rosenzweig, Univ. of New Orleans [6370-03]

11:25 am: **Self-assembly for nanointegration (Tutorial)**, Y. Cui, Stanford Univ. [6370-04]

Lunch Break 12:00 to 1:30 pm

SESSION 2

Hynes Conv. Ctr. Room 102 Sun. 1:30 to 3:40 pm

Synthesis, Organization, and Incorporation of Nano-Structures III

Chairs: Nibir K. Dhar, Army Research Lab.;
Sharka M. Prokes, Naval Research Lab.

Keynote

1:30 pm: **Nanodevices and electric nanogenerators based on ZnO nanobelts and nanowires (Invited Paper)**, Z. L. Wang, Georgia Institute of Technology [6370-05]

2:10 pm: **Germanium nanowire based devices (Invited Paper)**, S. Guha, E. Tutuc, IBM Thomas J. Watson Research Ctr. [6370-06]

2:35 pm: **Epitaxial III-V nanowires on a Si substrate (Invited Paper)**, L. C. Chuang, M. J. Moewe, S. M. Crankshaw, N. P. Kobayashi, C. C. Chang, C. J. Chang-Hasnain, Univ. of California/Berkeley [6370-07]

3:00 pm: **A physics based model for transport in semiconductor nanowires**, M. S. Islam, I. Kimukin, Univ. of California/Davis; M. Anwar, Univ. of Connecticut [6370-08]

3:15 pm: **Semiconductor nanowires for electronics: hierarchical growth and applications (Invited Paper)**, D. Wang, Univ. of California/San Diego . [6370-09]

Coffee Break 3:40 to 4:00 pm

SESSION 3

Hynes Conv. Ctr. Room 102 Sun. 4:00 to 5:30 pm

Synthesis, Organization, and Incorporation of Nano-Structures III

Chairs: Shashi P. Karna, U.S. Army Research Lab.;
Nibir K. Dhar, Army Research Lab.

4:00 pm: **Polar-surface induced novel growth configurations of piezoelectric nanobelts**, Z. L. Wang, Georgia Institute of Technology [6370-10]

4:15 pm: **Catalyst-free selective-area MOVPE of semiconductor nanowires (Invited Paper)**, J. Motohisa, T. Fukui, Hokkaido Univ. (Japan) [6370-11]

4:40 pm: **Magnetically assembled and magneto-transport studies of single ferromagnetic nanowires (Invited Paper)**, N. V. Myung, B. Yoo, Y. Rheem, W. Beyermann, Univ. of California/Riverside [6370-12]

5:05 pm: **Laser nanoprocessing using near-field probes (Invited Paper)**, C. P. Grigoropoulos, Univ. of California/Berkeley [6370-13]

Monday 2 October

SESSION 4

Hynes Conv. Ctr. Room 102 Mon. 8:30 to 10:10 am

CNT: Material Synthesis, Properties, Devices, and Sensors II

Chairs: Yi Cui, Stanford Univ.;
Burhan Bayraktaroglu, Air Force Research Lab.

8:30 am: **A modified high-resolution TEM for thermoelectric properties measurements of nanowires and nanotubes (Invited Paper)**, C. Dames, Massachusetts Institute of Technology; S. Chen, Boston College; C. T. Harris, Massachusetts Institute of Technology; J. Huang, Z. Ren, Boston College; M. S. Dresselhaus, G. Chen, Massachusetts Institute of Technology . [6370-14]

8:55 am: **Electrical properties of single-walled carbon nanotube films (Invited Paper)**, A. Ural, Univ. of Florida [6370-15]

9:20 am: **A computational study of carbon nanotube optoelectronic devices (Invited Paper)**, Y. Yoon, Univ. of Florida; M. Alam, Purdue Univ.; J. Guo, Univ. of Florida [6370-16]

9:45 am: **Structure and property studies on carbon nanotubes (Invited Paper)**, Z. Ren, S. Chen, J. Huang, Z. Wang, Boston College; G. Chen, M. S. Dresselhaus, Massachusetts Institute of Technology [6370-17]

Coffee Break 10:10 to 10:30 am

SESSION 5

Hynes Conv. Ctr. Room 102 Mon. 10:30 am to 12:25 pm

CNT: Material Synthesis, Properties, Devices, and Sensors II

Chairs: **Burhan Bayraktaroglu**, Air Force Research Lab.;
Nibir K. Dhar, Army Research Lab.

Keynote

10:30 am: **Analysis and design of key phenomena in electronics: integrated circuits, devices and nanostructures** (*Invited Paper*), N. Goldman, Univ. of Maryland/College Park [6370-18]

11:10 am: **Carbon nanotube-based electronics and sensors: opportunities and challenges** (*Invited Paper*), S. P. Karna, U.S. Army Research Lab. [6370-19]

11:35 am: **Manufacturable biosensors based on carbon nanotubes and In₂O₃ nanowires** (*Invited Paper*), C. Zhou, Univ. of Southern California [6370-20]

12:00 pm: **Advances in carbon nanotube-based chemical sensors** (*Invited Paper*), F. K. Perkins, E. S. Snow, J. A. Robinson, Naval Research Lab. [6370-21]

Tuesday 3 October

SESSION 6

Hynes Conv. Ctr. Room 102 Tues. 1:30 to 3:40 pm

Synthesis, Assembly, Characteristics, and Integration of Nanostructure for Device Applications II

Chairs: **Ant Ural**, Univ. of Florida; **Yi Cui**, Stanford Univ.

Keynote

1:30 pm: **Sensing and catalysis on the nano-scale** (*Invited Paper*), M. Moskovits, X. H. Chen, Univ. of California/Santa Barbara; A. A. Kolmakov Southern Illinois Univ./Carbondale; Y. Lilach, Pacific Northwest National Lab.; A. Morrill, Univ. of California/Santa Barbara [6370-64]

2:10 pm: **Nanowire based chemical and biosensors** (*Tutorial*), C. Zhou, Univ. of Southern California [6370-22]

2:45 pm: **Synthesis, characterization, and physical properties of transition metal silicide nanowires** (*Invited Paper*), S. Jin, Univ. of Wisconsin/Madison [6370-23]

3:10 pm: **A novel technique for precise positioning of metal-catalyzed semiconductor nanowires**, C. W. Edgar, C. D. Johns, L. VJ, M. S. Islam, Univ. of California/Davis [6370-24]

3:25 pm: **Growth and characterization of single crystal InAs nanowire arrays using a simple vapor growth method**, S. M. Prokes, Naval Research Lab.; H. D. Park, Johns Hopkins Univ. and Naval Research Lab.; A. Gaillot, R. C. Cammarata, Johns Hopkins Univ. [6370-25]

Coffee Break 3:40 to 4:00 pm

SESSION 7

Hynes Conv. Ctr. Room 102 Tues. 4:00 to 5:45 pm

Synthesis, Assembly, Characteristics, and Integration of Nanostructure for Device Applications II

Chairs: **Jia G. Lu**, Univ. of California/Irvine;
M. Saif Islam, Univ. of California/Davis

4:00 pm: **Integration of phase-change and silicon nanowires for nanoelectronics** (*Invited Paper*), Y. Cui, S. Meister, H. Peng, J. Zhu, Stanford Univ. [6370-27]

4:25 pm: **Unique mechanism of semiconductor nanowire growth**, N. P. Kobayashi, S. Wang, R. S. Williams, Hewlett-Packard Labs. [6370-28]

4:40 pm: **New bio-inorganic photo-electronic devices based on photosynthetic proteins**, N. Lebedev, Naval Research Lab.; A. Spano, Univ. of Virginia; S. A. Trammell, Naval Research Lab.; I. Griva, George Mason Univ. [6370-29]

4:55 pm: **Controlling electrochemical growth of conducting polymer nanotube: ultrafast electrochromics** (*Invited Paper*), S. B. Lee, S. I. Cho, R. Xiao, R. Liu, Univ. of Maryland/College Park [6370-30]

5:20 pm: **Ozone sensing utilizing nanostructured metal oxide thin films** (*Invited Paper*), G. Kiriakidis, Foundation for Research and Technology-Hellas (Greece) [6370-31]

✓ Posters-Tuesday

A poster reception, with authors present at their posters, will be held Tuesday evening from 6:00 to 7:30 pm in the Hynes Convention Center Exhibit Hall A. Light refreshments will be served. Poster authors may begin displaying their posters after Noon on Monday and will be asked to leave their posters up until 7:30 pm on Tuesday. All posters must be posted by 5:00 pm on Tuesday. Poster authors, see p. 76 for setup instructions.

✓ **A study on very thin sheet microformability by using laser ultrafast microforming**, H. Tao, JiangSu Univ. (China) [6370-49]

✓ **Using scanning near-field optical microscope couple with femtosecond laser to lithograph**, F. Yan, JiangSu Univ. (China) [6370-50]

✓ **Demonstration of integrated optical functions by multiscale composite microstructures**, X. Deng, NanoOpto Corp. [6370-51]

✓ **Determination of residual deformation of polymeric nanostructures using microscopic Moiré interferometry**, X. Zheng, Y. Zhao, X. Zhang, Boston Univ. [6370-52]

✓ **Gallium nitride nanowires: polar surface controlled growth, ohmic contact patterning by focused ion beam induced direct Pt deposition and disorder effects, variable range hopping, and resonant electromechanical properties**, C. Nam, D. Tham, P. Jaroenapibal, J. Kim, D. E. Luzzi, Univ. of Pennsylvania; S. Evoy, Univ. of Alberta (Canada); J. E. Fischer, Univ. of Pennsylvania [6370-53]

✓ **The Wigner function in signal processing of nanostructures**, M. Palmoor, D. George, T. Materdey, Univ. of Massachusetts [6370-55]

✓ **A silicon-based biosensor using subwavelength structures for sensitive molecular detection**, G. J. Sonek, Merrimack College [6370-57]

✓ **Spectral selectivity of photonic crystal infrared photodetectors**, L. Chen, W. Zhou, The Univ. of Texas at Arlington; G. J. Brown, Air Force Research Lab. [6370-58]

✓ **Template-synthesized multifunctional nanotubes for biomedical applications**, S. B. Lee, S. J. Son, B. He, X. Bai, Univ. of Maryland/College Park [6370-59]

✓ **Nanostructure based sensors for environmental monitoring and control**, B. Das, Univ. of Nevada/Las Vegas [6370-61]

✓ **Nanostructured multispectral sensors**, B. Das, Univ. of Nevada/Las Vegas [6370-62]

Wednesday 4 October

SESSION 8

Hynes Conv. Ctr. Room 102 Wed. 8:30 to 10:10 am

Quantum Structures, Organic, and Inorganic and Photonic Devices for Sensing and Imaging

Chairs: **Regina Ragan**, Univ. of California/Irvine; **Sang Bok Lee**, Univ. of Maryland/College Park

8:30 am: **Nanoscale antimony pH sensor** (*Invited Paper*), J. G. Lu, Univ. of California/Irvine [6370-32]

8:55 am: **Gas sensors from quasi-1D metal oxide nanostructures: fabrication, sensitization, performance** (*Invited Paper*), A. A. Kolmakov, Southern Illinois Univ. Carbondale [6370-33]

9:20 am: **Nanosensors based on lanthanide compounds** (*Invited Paper*), S. Petoud, A. M. Yingling, D. A. Chengelis, C. M. Chade, G. R. Filipczyk, D. S. Oxley, P. D. Badger, Univ. of Pittsburgh [6370-34]

9:45 am: **Nanoparticles superstructures** (*Invited Paper*), N. A. Kotov, Univ. of Michigan [6370-35]

Coffee Break 10:10 to 10:30 am

SESSION 9

Hynes Conv. Ctr. Room 102 Wed. 10:30 am to 12:05 pm

**Nano-Systems Fabrications and Hybrid Systems for
Biological and Molecular Sensing, Diagnosis and
Recognition**

*Chairs: Regina Ragan, Univ. of California/Irvine;
Jia G. Lu, Univ. of California/Irvine*

- 10:30 am: **Creating optimized platforms for biosensor systems**
(Invited Paper), R. Ragan, Univ. of California/Irvine [6370-36]
- 10:55 am: **Surface modification of nanocrystalline ZnO for bio-sensing applications**, D. M. Steeves, J. W. Soares, U.S. Army Research, Development and Engineering Command [6370-37]
- 11:10 am: **Ordered DNA arrays prepared via soft lithography techniques**, M. Rahman, B. Day, C. Meadows, M. L. Norton, Marshall Univ. [6370-38]
- 11:25 am: **Block-copolymer/Au-nanoparticle hybrid thin films for hydrocarbon sensing application**, N. Madamopoulos, A. Tsigara, G. Manasis, L. Athanasekos, A. Meristoudi, S. Pispas, N. A. Vainos, National Hellenic Research Foundation (Greece) [6370-39]
- 11:40 am: **Resonant-enhanced localized surface plasmon resonance spectroscopy** *(Invited Paper)*, A. J. Haes, The Univ. of Iowa and Northwestern Univ.; S. Zou, J. Zhao, G. C. Schatz, R. P. Van Duyne, Northwestern Univ. [6370-40]
- Lunch Break 12:05 to 1:15 pm

SESSION 10

Hynes Conv. Ctr. Room 102 Wed. 1:15 to 4:10 pm

**Novel Synthesis, Characterization, and Applications of
Organic and Inorganic Nano-Structures**

*Chairs: Sang Bok Lee, Univ. of Maryland/College Park;
Achyut K. Dutta, Banpil Photonics, Inc.*

- 1:15 pm: **Concentration gradient donor-acceptor profiles in polymer solar cells** *(Invited Paper)*, J. R. Heflin, Virginia Polytechnic Institute and State Univ. [6370-41]
- 1:40 pm: **Venturi-assisted nanospray protein ion generation by a micromachined ultrasonic electro spray array** *(Invited Paper)*, F. M. Fernandez, C. Y. Hampton, M. Meacham, A. Fedorov, L. F. Degertekin, Georgia Institute of Technology [6370-42]
- 2:05 pm: **Nonlithographic nanostructure devices and circuits**, B. Das, A. N. Banerjee, Univ. of Nevada/Las Vegas [6370-43]
- 2:20 pm: **Transmission line circuit representation of surface plasmon waves** *(Invited Paper)*, A. Talias, J. Sarma, F. Causa, Univ. of Bath (United Kingdom) [6370-44]
- 2:45 pm: **Functional 1D nanostructures as photoconductor, molecular sensor, and wavelength-selective nanoswitch** *(Invited Paper)*, L. Chen, National Taiwan Univ. (Taiwan); K. Chen, Academia Sinica (Taiwan) . . . [6370-45]
- Coffee Break 3:10 to 3:30 pm
- 3:30 pm: **Heterogeneous integration of semiconducting and carbide nanowires** *(Invited Paper)*, L. Tsakalacos, GE Global Research [6370-63]
- 3:55 pm: **Image-based nanocrystallography: fringe fingerprinting in two and three dimensions and methodology to derive the morphology of nanocrystals**, P. Moeck, B. Seipel, Portland State Univ.; P. B. Fraundorf, Univ. of Missouri/St. Louis [6370-46]

Course of Related Interest

Register for courses and get full course descriptions at the SPIE Registration desk.

SC673 Optical Fiber Sensing Technology: Principles, Components & Applications (Méndez) Monday, 1:30 to 5:30 pm