

# SUMMER ACTIVITIES

NATIONAL INSTITUTE OF NANO ENGINEERING



# NINE SUMMER ACTIVITIES

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# CENTER FOR INTEGRATED NANOTECHNOLOGIES (CINT)

**Speaker:** Neal Shinn

**Date:** Monday, July 28

**Time:** 12:45 p.m.

**Duration:** 45 minutes

**Location:** CINT Bldg. 518, Rooms 1026 & 1028

**Maximum Number of Attendees:** 20

**About the Seminar and Tour:** This activity includes a brief overview of CINT, selected nanoscience highlights, and a building tour. CINT is a DOE Office of Basic Energy Sciences nanoscale science research center operated as a national user facility by Los Alamos and Sandia National Laboratories. Through its Core Facility (Albuquerque, NM) and Gateway to Los Alamos Facility (Los Alamos, NM), CINT provides access to tools and expertise to establish the scientific principles that govern the design, performance, and integration of nanostructured materials into the micro- and macro worlds. Our users work with staff scientists to exploit expertise in four scientific thrusts: Nanophotonics & Optical Nanomaterials; Nanoscale Electronics, Mechanics & Systems; Soft, Biological & Composite Nanomaterials; and Theory and Simulation of Nanoscale Phenomena.



## Related Links:

CINT Main Website: <http://cint.lanl.gov/>



## About the Speaker:

Neal Shinn is the User Program Manager for the Center for Integrated Nanotechnologies (CINT), a collaborative nanoscale science research center jointly operated as a National User Facility by Los Alamos and Sandia National Laboratories for the U.S. Department of Energy, Office of Basic Energy Sciences. Neal received a B.S. degree in Chemistry and Mathematics from the Pennsylvania State University and a Ph.D. degree in Chemical Physics from the Massachusetts Institute of Technology. Thereafter, he was a National Research Council Post-Doctoral Fellow at the National Institute of Standards and Technology, where his research involved the elucidation of surface reaction intermediates using vibrational and electronic spectroscopies in conjunction with thermal and stimulated desorption. In 1985, he joined Sandia as a Senior Member of the Technical Staff, later becoming the Manager of the Surface and Interface Science Department prior to his current position. He has published more than 80 scientific papers, serves on DOE and academic advisory boards, and was the 2007 President of the AVS Science & Technology Society.

# SOLAR POWER TOUR

**Speaker:** Nate Siegel

**Date:** Monday, July 28

**Time:** 11:00 a.m.

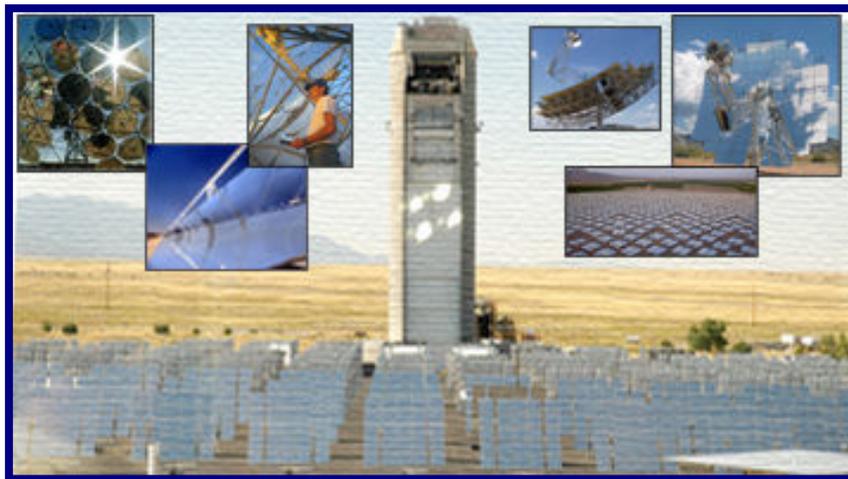
**Duration:** 1 hour

**Location:** Solar Power Tower

**Maximum Number of Attendees:** 40

## About the Tour:

Concentrating Solar Power (CSP) technologies use mirrors to collect solar energy in the form of heat that can be used to drive power cycles or chemical processes. Unlike other solar technologies such as photovoltaics (PV), CSP offers the ability to store solar energy in the form of heat thus enabling CSP facilities to operate around the clock. This seminar will include an introduction to CSP technologies, a discussion of their potential for power and fuel production, an overview of ongoing R&D, and a tour of the National Solar Thermal Test Facility.



## Related Links:

<http://www.energylan.sandia.gov/sunlab/>

[www.nrel.gov/csp/troughnet/](http://www.nrel.gov/csp/troughnet/)

<http://www1.eere.energy.gov/solar/csp.html>



## About the Speaker:

Nathan Siegel is a mechanical engineer in the Solar Technologies Department at Sandia National Laboratories. He is currently involved in projects focusing on solar fuels production (hydrogen and hydrocarbon), high temperature heat transfer and storage fluids (molten salts), and advanced central receiver systems for high temperature power production and chemical processes. He recently pioneered the process of cooking hot dogs using a solar furnace at power levels in excess of  $6500 \text{ kW/m}^2$  (6500 suns).

# DREAM BIG, THINK SMALL: THE AMAZING WORLD OF MEMS & NANOTECHNOLOGY

**Speaker:** Marlene Bourne

**Date:** Monday, July 28

**Time:** 1:30 pm

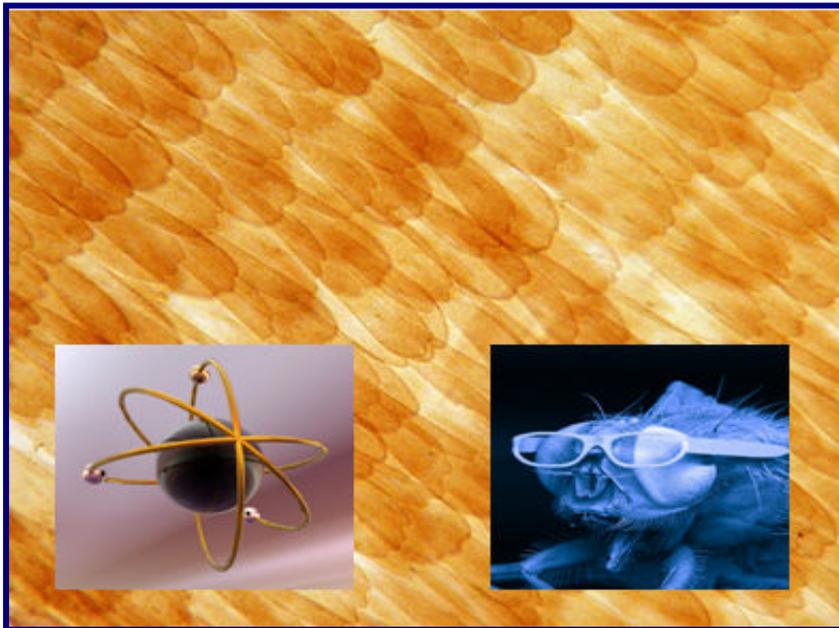
**Duration:** 1 hour

**Location:** CINT Bldg 518, Rooms 1026/1028

**Maximum Number of Attendees:** 25

## About the Seminar:

Edible restaurant menus. Night vision. Implantable sensors. Paper batteries. These are just a few exciting examples of how MEMS and nanotechnology are being put to use in *real* products today – and the possibilities are endless. There's no question that when it comes to next-generation science and engineering, small is cool! From food and clothing, to medicine and robotics, we'll take a look at the current state-of-the-art of MEMS and nanotechnology, and then explore how both are playing a major role in re-shaping our future.



## Related Links:

[.bournereport.com](http://.bournereport.com)



## About the Speaker:

Marlene Bourne, President & Principal Analyst of Bourne Research LLC, is internationally recognized as one of the leading experts on MEMS (micro-electro-mechanical systems) and its convergence with nanotechnology. With nearly 15 years of expertise as an industry analyst, Marlene has provided insight on emerging technologies to many business and technical publications, including *Business 2.0*, *BusinessWeek*, *The Economist*, *Forbes*, *Investor's Business Daily*, *Los Angeles Times Magazine*, *the New York Times*, *USA Today* and the *Wall Street Journal*. Marlene produces and hosts a weekly radio show, *The Bourne Report*, which airs Sunday afternoons on Independent 1310 KXAM in Phoenix and streams live on the Internet to a global audience. She is also the author of two award-winning books: *A Consumer's Guide to MEMS & Nanotechnology*, and *MEMS & Nanotechnology for Kids*.

# EFFECTIVE PRESENTATION SKILLS

**Speaker:** Judie Knoerle

**Date:** Monday, June 9

**Time:** 9:00 a.m.

**Duration:** 3 hours

**Location:** 858EL, Room 1410

**Maximum Number of Attendees:** 45

## About the Seminar:

The three hour seminar is designed to both raise awareness and provide practice opportunities on the delivery and structure of effective presentations.

The facilitator will introduce, demonstrate and coach volunteers on delivery techniques that include:

- Appropriate gestures
- Proper eye contact
- Strong voice projection and modulation

In addition to delivery skills, participants will:

- Learn how to smoothly integrate visual aids
- Understand and use a simple Three-Step presentation structure to ensure every presentation is effective

Participants will also receive:

- Additional resources and links
- Practical practice tips
- Presentation check list

## Related Links:

[www.upfrontpresentations.com](http://www.upfrontpresentations.com)



## About the Speaker:

*"People love to learn. They learn best in a safe, interactive environment that promotes experimentation with new skills and concepts that apply directly to their business and personal lives."*

Judie is an international business consultant, executive coach and seminar facilitator with a Master's Degree in Counseling and Education. She has 24 years of coaching, facilitating and designing workshops. She has worked with Sandia Laboratories for more than five years.

She is the co-author of a Global Presentation Skills program, **UPFRONT Persuasion Through Presentation** and **meetingsUPFRONT**, a meeting management program. Judie is a partner in **dAK & Company**, an independent course designer and a business partner with Wilson Learning Worldwide.

# NOW YOU'RE COOKING: NANOPARTICLE SYNTHESIS & CHARACTERIZATION WORKSHOP

**Speakers:** Bernadette A. Hernandez-Sanchez, Mark Rodriguez, and Chad Parish

**Date:** Wednesday, July 30

**Time:** 8:45 a.m.      **Duration:** 4 hours

**Location:** Advanced Materials Laboratory

**Maximum Number of Attendees:** 12 (+ 4 possible alternates)

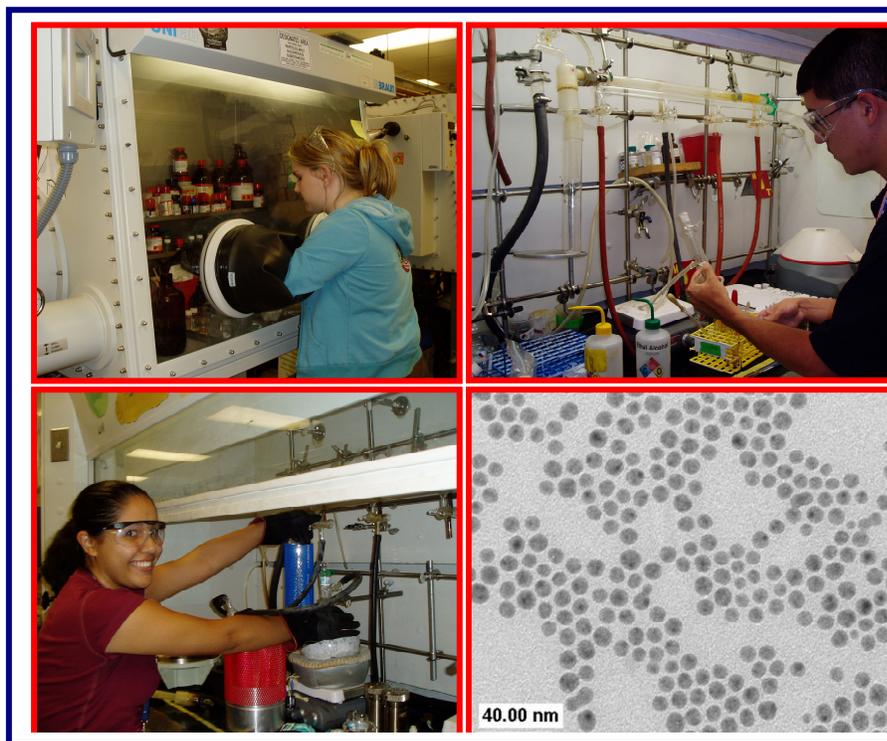
## About the Workshop:

Are you tired of not knowing how to make nanomaterials? Do you fret over what steps to take to make sure you have the right nanoproducts? Do you want to learn how to stick your nanoparticles onto micron size stuff? Well, stop your worrying and come learn how to overcome these challenges! This workshop will cover basic synthetic routes used to generate nanomaterials and how to characterize them. Participants will get hands-on experience in making nanomaterials. Fundamental characterization techniques such as X-ray diffraction, Uv-Vis spectroscopy, and Transmission Electron Microscopy will also be introduced and explored.



## About the Speaker:

Dr. Bernadette A. Hernandez-Sanchez is an inorganic chemist at Sandia National Laboratories. Her current research is focused on understanding nanomaterial structure-property relationships and controlling the synthesis, assembly, and morphology of nanomaterials for applications ranging from in non-toxic bio-imaging agents to ferroelectric nanoparticles. In addition, Bernadette has contributed to Sandia's science outreach efforts in K-12 to postdoctoral education.



## Related Links:

[www.sandia.gov/materials/science/visiting/aml.html](http://www.sandia.gov/materials/science/visiting/aml.html)

[www.sandia.gov/LabNews/070216.html](http://www.sandia.gov/LabNews/070216.html)

# MICROSYSTEMS & ENGINEERING SCIENCE APPLICATIONS TOUR

**Speakers:** Carol Sumpter

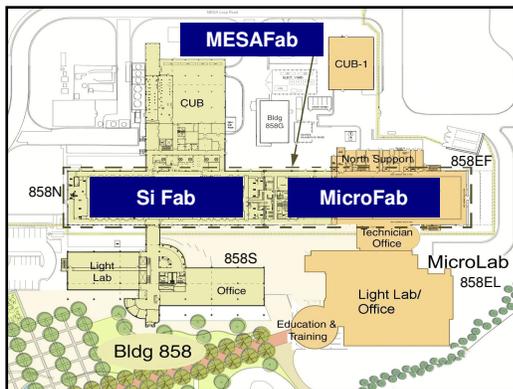
**Date:** Monday, June 23

**Time:** 11:00 a.m.      **Duration:** 1 hour

**Location:** Bldg 858EL, Room L1500

**Maximum Number of Attendees:** 10

The MESA Complex is designed to integrate the numerous scientific disciplines necessary to produce functional, robust, integrated microsystems and represents the center of Sandia's investment in microsystems research, development, and prototyping activities. This suite of facilities encompasses approximately nearly 400,000 square feet and includes cleanroom facilities, laboratories and offices.



The MESA Fab includes the Silicon Fab and the MicroFab. The focus of the Silicon Fab is the development, application and production of radiation hardened CMOS integrated circuit technologies capable of realizing digital, analog, mixed-mode, and nonvolatile memory

circuits for the nuclear stockpile. In addition, the silicon wafer fab is the world's premier R&D source of surface micromachining technology. The facility includes 12,500 square feet of class 1 clean room space. The MicroFab includes 13,700 square feet of Class 10 clean room space designed for flexibility to allow development of a range of compound semiconductor based optoelectronic, RF, and photonic microsystem technologies.



## About the Speaker:

Carol W. Sumpter received the B.S. degree in electrical engineering in 1980, and the MBA degree in new product development and technical marketing in 1988, both from The University of New Mexico. She was the Class of 1988 Outstanding MBA Student and the University of New Mexico 1988 Marketing Scholar of the Year. She served as a Research Intern at Bell Telephone Laboratories in Murray Hill, NJ, in 1980 and worked for Motorola, Inc. and Fairchild Semiconductor as a Device Engineer and R&D Product Engineer. She joined Sandia National Laboratories in 1989. She served as the Sandia Liaison to the Semiconductor Industry Association from 1996 to 1997. She currently works in the Microsystems Science, Technology, and Components Center at Sandia National Laboratories and serves as a Principal Member of the Technical Staff. Her job responsibilities revolve around strategic and business planning for the Center including support for both internal and external programmatic coordination. Memberships include but are not limited to Institute of Electrical and Electronics Engineers (IEEE), IEEE Engineering Management, etc.

# INNOVATION PRESENTATIONS

## LIFE BIOSCIENCE, INC. & ADVENT SOLAR, INC.

**Speakers:** Jeb Fleming, James Gee  
**Date:** Tuesday, July 29  
**Time:** 9:45 a.m.      **Duration:** 1.15 hours  
**Location:** Bldg 858EL, Room 1410  
**Maximum Number of Attendees:** 45

### Life BioScience, Inc.

The LBSI family of products equip scientists worldwide with a broad portfolio of best-in-class, reliable, and time-saving technologies. We offer products and services that support academic and government research institutions, pharmaceutical and biotech companies worldwide in their efforts to improve the human condition. The company provides technologies that are used for in vivo diagnostics, disease research, drug discovery, and micro-electromechanical fabrication.

The LBSI mission is “Making Life better Through Science.” LBSI strives to advance life science research through the discovery and commercialization of innovative products that identify disease, restore health and deliver outstanding value to our customers and shareholders.



### Advent Solar, Inc.

Advent Solar, Inc. is a manufacturer of advanced technology solar cells and modules. Founded in 2002, Advent Solar began operations in 2003, and is poised to become an industry leader with our innovative back-contact cell technology and module assembly. Our state-of-the-art facility is in Albuquerque, New Mexico, USA, where the next generation of technology meets lean manufacturing, and ensures Advent can respond quickly to the needs of the rapidly growing photovoltaic market.

Advent is committed to a higher level of customer service, because we have a higher understanding of the market and the technology itself.



### About the Speakers:

**Jeb Fleming** serves as Life BioScience's technology architect and chief engineer. Prior to starting Life BioScience, Jeb was the principal investigator of a wide variety of projects at Sandia National Laboratories including neutron generators for nuclear weapons, correlation spectrometers for the infrared detection of combustion byproducts, and the innovative  $\mu$ Post technology, which won a prestigious R&D 100 award in 2007. Jeb has been the inventor or co-inventor on more than 10 patents and has led the development work associated with Life BioScience's innovative product platforms. Jeb has both a BS and MS degrees in Chemical Engineering and a MBA from the Anderson School of Management at UNM.

**James Gee** is the founder and technical officer for Advent Solar. James spent 18 years focused on various aspects of PV solar energy research as part of his 24-year career at Sandia National Laboratories. His roles included researcher, project/team leader, and department manager. He and his team made several advances in PV technology, including the world's first demonstration of a 30% efficient solar cell, the world's first demonstration of a 20% efficient mono-crystalline-silicon PV module, and the world's first 15% efficient multi-crystalline-silicon PV module. James was a member of the management team of the National Center for Photovoltaics, where he facilitated, edited, and helped publish the U.S. Photovoltaic Industry Roadmap in 2000. He is the lead inventor for the intellectual property exclusively licensed to Advent Solar from SNL, and is a recognized world leader in his field. James has an MS in Electrical Engineering from Stanford University and a BS in Electrical Engineering from Rice University. He has been granted seven U.S. patents, and has published over 40 papers.



# SCANNING ELECTRON MICROSCOPY AND NANOMANIPULATION

**Speaker:** Brian Swartzentruber

**Date:** June 23, 27, or 30 (3 separate sessions)

**Time:** 1:00 p.m.      **Duration:** 2-3 hours

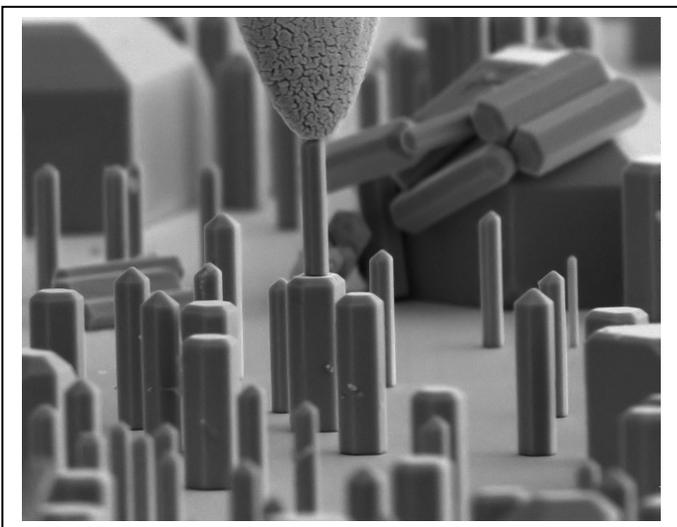
**Location:** CINT Bldg 518, Room 1102

**Maximum Number of Attendees:** 3

## About the Seminar:

In this 'hands on' lab, the students will be taught how to use the JEOL 6701F Scanning Electron Microscope (SEM). This SEM is equipped with a custom nanomanipulator for probing the electronic structure of nanorods and wires. We will set up the nanomanipulator to perform current-voltage characteristics of GaN or GaAs rods.

There will be plenty of time for each student to operate the instrument, take IV spectra, and try their hand at manipulation.



## About the Speaker:

Brian Swartzentruber designed and built the nanomanipulation system in the SEM for the CINT Core facility. Most of his scientific career has been spent studying surface structure and atomic motion on crystal surfaces using scanning tunneling microscopy.

# INTRODUCTION TO ATOMIC FORCE MICROSCOPY

**Speaker:** Doug Pete

**Date:** June 23, 27, or 30 (3 separate sessions)

**Time:** 1:00 p.m.      **Duration:** 2-3 hours

**Location:** CINT Bldg 518, Room 1103

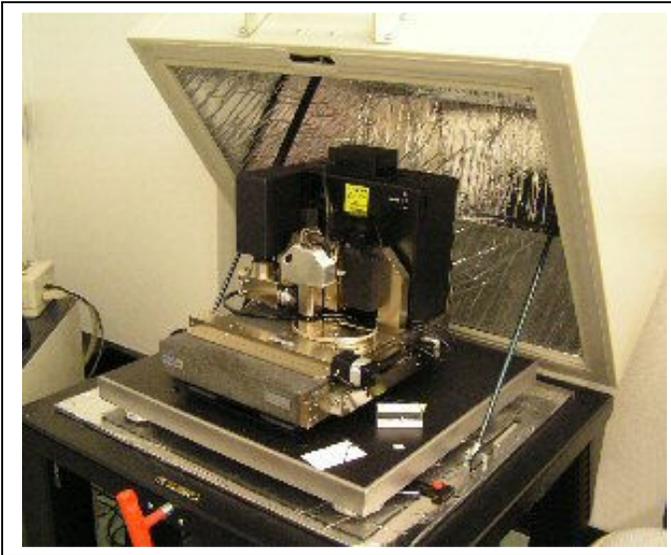
**Maximum Number of Attendees:** 3

## About the Seminar:

In this hands-on lab, the students will be taught how to use the Veeco DI 3100 Atomic Force Microscope (AFM). We will start off looking at the 'calibration' type samples and then move on to imaging nanostructures.

Plenty of time is allotted for each student to have the opportunity to run the instrument.

AFMs are now common place instruments in nanotechnology laboratories. They are used for routine inspection of nanostructures, manipulation of nanostructures, as well as, capacitance, conductance, and electronic structure measurements of thin films and devices.



## About the Speaker:

Doug Pete is responsible for running the Scanning Probe Microscopy lab at the CINT Core facility. The lab contains two ultra-high vacuum (UHV) scanning tunneling microscopes, an UHV AFM, and the "work horse" ambient AFM used in this session.

# OVERVIEW OF MICROSYSTEMS TECHNOLOGIES & APPLICATIONS

**Speaker:** Dr. Ted. Dellin

**Date:** Monday, June 30 - Thursday, July 3

**Time:** 9:00 – 2:00 p.m.

**Duration:** 18 hours

**Location:** CINT Bldg 518, Rooms 1026 & 1028

**Maximum Number of Attendees:** 45

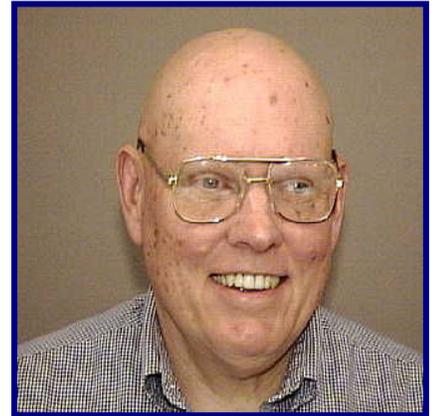
## About the Seminar:

The course starts with the basic properties of semiconductors, how they can be engineered and the basic building block of all devices - the pn junction. The course then considers the MOS transistor and CMOS IC, followed by the fundamental semiconductor processing techniques, CMOS processing and packaging. The seminar then shifts to optoelectronics, considering how semiconductors absorb and emit light and the major optoelectronic devices such as photodetector, solar cell, LED and laser diode, followed by how silicon IC processing can be used to make bulk and surface micromachined devices. The course concludes with considering how to integrate two or more of these technologies into a microsystem, using examples such as the Analog Devices accelerometer and TI Digital Mirror Device. The seminar includes the **21<sup>st</sup> Century Semiconductor Technology Handbook**.



## Related Links:

<http://www.quickstartmicro.com/microelectronics,optoelectronics,microsystems.htm>



## About the Speaker:

In his semi-retirement Dr. Ted Dellin works part-time on training and the future of ICs. Through his company, Quick Start Micro Training LLC, he develops better methods to help working adults acquire an intuitive understanding of semiconductor devices, technology and reliability. He also continues to lead the development of the reliability section of the International Technology Roadmap for Semiconductors. In 2004 Dr. Dellin retired as the Chief Scientist of the Microsystems Center at Sandia National Laboratories. He is a past chair of the NV Memory Workshop, a recipient of the Federal Laboratories Consortium award for technology transfer and has given five tutorials at the IEEE International Reliability Physics Symposium. He has a PhD in Physics from the City University of New York.

# BUSINESS CONCEPTS FOR SCIENTISTS AND ENGINEERS

**Speaker:** Regan Stinnett

**Date:** Friday, July 18

**Time:** 1:00 p.m.

**Duration:** 45 minutes

**Location:** CINT Bldg 518, Rooms 1026 & 1028

**Maximum Number of Attendees:** 45

## About the Seminar:

The field of nanotechnology provides an exciting foundation for generating potentially world-changing advances covering a spectrum of applications. Many scientists and engineers working in this area dream of seeing their most exciting technology advances successfully make the transition from laboratory demonstration to commercial product.

In order for this to happen it is important that inventors learn enough about the business world to be able to effectively communicate the value of their ideas to business people and to learn from them about the process involved in technology commercialization. This requires that scientists and engineers become familiar with basic business concepts and vocabulary as well as the most important motivators and constraints involved in the business of technology commercialization.

In this presentation we will discuss, from a technologist's point of view, some practical but fundamental concepts that are key to successful commercialization of technology advances.



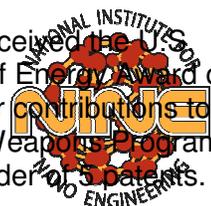
## About the Speaker:

Dr. Regan Stinnett is Program Manager for the National Institute for Nano Engineering (NINE) at Sandia National Laboratories. Regan did his thesis work in plasma physics, graduating from the University of Texas at Austin.

He was hired by Sandia to do research in inertial confinement fusion and pulsed power. For several years he led the Ion Source and Beam Experiments Departments. After co-inventing a new ion beam surface treatment technology, Regan left Sandia to found Quantum Manufacturing Technologies Inc., where he served as President and CEO.

Since his return to Sandia, he has worked with the MESA team on Microsystems technologies, established new partnerships between Sandia's micro/nano programs and U.S. universities, worked with Sandia's Advanced Concepts Group, co-leading its study of microsensor systems for the War on Terrorism, and served as manager for the Intrusion Detection Technologies Department. In 2007, Regan became Program Manager for NINE.

Regan has received the U.S. Department of Energy Award of Excellence for contributions to the Nuclear Weapons Program and is the holder of 5 patents.



# BUSINESS AND ACCOUNTING CONCEPTS FOR SCIENTISTS AND ENGINEERS

**Speaker:** Dr. Craig G. White

**Date:** Friday, July 18

**Time:** 2:00 p.m.

**Duration:** 1.5 hours

**Location:** CINT Bldg 518, Rooms 1026 & 1028

**Maximum Number of Attendees:** 45

## About the Seminar:

Accounting information serves a variety of important functions in the planning and operation of a business. These functions include projecting sources and uses of funds, communicating operating results to stakeholders, and identifying business risk. Accounting is based on conventions. An understanding of these conventions helps empower the manager/owner.

The focus of this seminar will be on the basics of preparing, reading, and the underlying assumptions of financial statements. The seminar will address questions such as the following: What are the methods of accounting? How does the income statement relate to the cash flow statement? What assets are included on the balance sheet? How are they measured? What is the fixed or variable nature of an expense? The answers to these questions will be illustrated using actual company financial statements.



## Related Links:

<http://aaahq.org/links.cfm>



## About the Speaker:

Dr. Craig White received his Bachelor of Business Administration with a major in Accounting from Texas A&M University, his Master of Science in Accounting and Ph.D. from Texas Tech University. Dr. White worked in the tax department of Price Waterhouse's Fort Worth, Texas office and has held a position at the University of New Mexico's Anderson School of Management (ASM) since 1998. He currently holds the Grant Thornton Professorship in Accounting.

Dr. White has taught in a variety of venues, including local and national accounting firms, the New Mexico Society of Certified Public Accountants (NMSCPA), and the American Institute of Certified Public Accountants' National Tax Education Program at the University of Illinois. He is currently a member of the Board of the NMSCPA.

Dr. White works closely with ASM's Management of Technology Program. He has also acted as a consultant on a wide variety of accounting and business issues. Dr. White's recent work includes projects for the U.S. Forest Service, the New Mexico State Engineer's Office, Waste Management, Inc., and the New Mexico Small Business Assistance Program.

# NANOTECHNOLOGY MARKETS & COMMERCIALIZATION ISSUES

**Speaker:** Dr. Steven Walsh

**Date:** Monday, July 21

**Time:** 1:15 p.m.

**Duration:** 1 hour

**Location:** CINT Bldg. 518, Rooms 1026 & 1028

**Maximum Number of Attendees:** 45

## About the Seminar:

This presentation addresses:

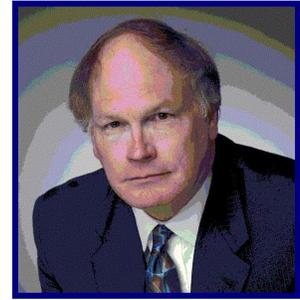
- Nanotech market size and segmentation
- Nanotech leaders
- US research and development and business development vis a vis other countries
- Trends in patents, publications, and commercialization

The last segment will suggest how firms might leverage this information to partners with nanotechnology knowledge centers, such as Sandia National Laboratories or the National Institute of Nano Engineering (NINE).

## Related Links:

[www.mancef.org](http://www.mancef.org)

<http://mot.mgt.unm.edu>



## About the Speaker:

Steven Walsh is the Alfred Black Professor of Entrepreneurship and the Co-Director of the Technology Management Center at the University of New Mexico's Anderson School of Management. He has been a Director at a Fortune 500 Company Division, General Manager and Vice President of medium-sized businesses and President of entrepreneurial and non-profit companies. Steve received his BEng and Strategic Management PhD at Rensselaer Polytechnic Institute. He has published more than 100 articles serving both the academic and practitioner communities, and he has assisted firms in gaining over \$200 million in equity resources in the past four years. Steve has been a plenary or invited speaker for more than 40 economic development groups and industrial organizations. He is Micro and Nanotechnology Commercialization Education Foundation's Founding Past President and Co-Editor of the international roadmap for MEMS and Top Down Nano technologies.



# SOCIAL, ETHICAL, LEGAL, AND REGULATORY ISSUES IN NANOTECHNOLOGY

**Speaker:** Michael E. Heintz

**Date:** Thursday, July 31

**Time:** 12:00 p.m.

**Duration:** 1.5 hours

**Location:** TBD

**Maximum Number of Attendees:** TBD

## About the Seminar:

This presentation will provide an overview of the societal considerations of nanotechnology as technical research and development transitions into commercialized products. What happens when nanotechnology products are placed into commerce? What regulations are appropriate? What other concerns or considerations should be made?

The presentation will address aspects of risks and benefits of nanotechnology released into commerce. Topics will include protection of human health and the environment, concerns raised by insurance companies, and efforts—sometimes conflicting—being taken to develop regulatory controls over the creation and spread of nanotechnology in society. The presentation will culminate in a discussion among attendees of the considerations that should be taken into account when new products are released into the stream of commerce.

## Related Links:

Nanotechnology Law Report: <http://www.nanolawreport.com>

## References:

Lin, P. (2007). Nanotechnology bound: Evaluating the case for more regulation. *Nanoethics*, 10. 105-122.

Lloyd. (2007). Nanotechnology: The big questions. *Emerging Risks, Franchise Performance*.

Monica, J.C., Heintz, M.E., Lewis, P.T. (2007). The perils of pre-emptive regulation. *Nature Nanotechnology*, 2. 68-70.

Full bio at:

<http://www.porterwright.com/attorneys/attorneyprofile.asp?attorneyid=458>



## About the Speaker:

Michael is an associate in Porter Wright's Environmental Practice Group and has experience in representing clients in a wide range of environmental matters including federal enforcement actions, citizen suits, administrative appeals, and environmental counseling and permitting. He focuses primarily in areas of solid and hazardous waste, water, and land use planning. In addition, he also has experience representing clients in real estate development matters, including financial incentives and tax abatements offered by the State of Ohio.

Michael frequently authors and presents on regulatory issues associated with both nanotechnology and global climate change. He is a contributing author to the Nanotechnology Law Report, a member of the *Nanotechnology Law & Business Journal's* advisory board, served as a coauthor for the recent ABA publication *Global Climate Change and U.S. Law*, and also coauthored a chapter on environmental trading programs in the December 2007 update to Matthew Bender's *Environmental Law Practice*



# NANOFEST: NANOTECHNOLOGY AND OUR GLOBAL ENERGY FUTURE

**Leaders:** Tom Karas and Lori Parrott

**Date:** July 31, 2008

**Time:** 8:30 - 3 PM

**Duration:** 6.5 hours

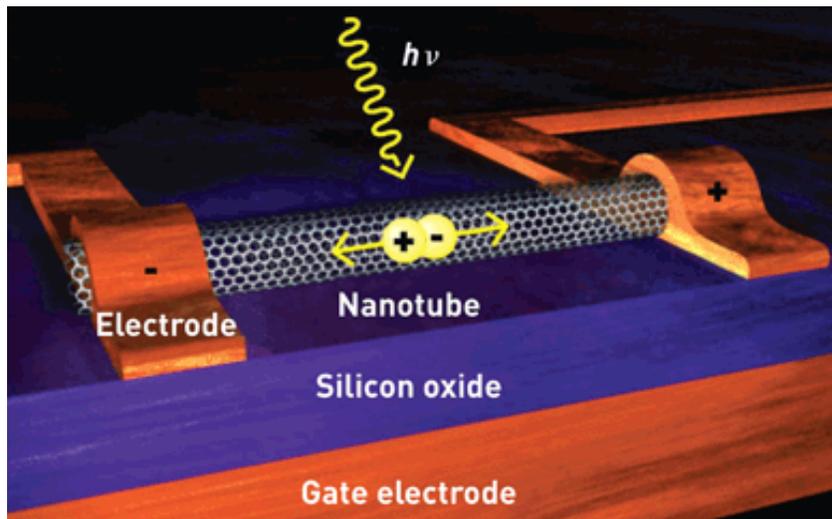
**Location:** TBD

**Maximum Number of Attendees:** TBD

**Location:** TBD

## About the Seminar:

This interactive workshop, or “fest,” will feature a series of structured brainstorms that explore new applications of nanotechnology to address global energy problems. Participants will be engaged in brainstorming, collaborating in small groups on new ideas, and discussing their ideas with the large group. Emphasis will be placed on understanding energy issues as complex human systems problems, with many technological, economic, and social interdependencies. Brainstorming will center on creative uses of nanotechnology to address these problems.



## Related Links:

[“Stabilization Wedges” \(Princeton\)](#)

[“Energy and Nanotechnology” \(Smalley\)](#)

[Harnessing Materials for Energy \(MRS Bulletin | April 2008\)](#)



## About the Leaders:

Lori Parrott manages the Strategic Studies group at Sandia, an organization that explores national security topics and issues on behalf of executive management. She has led laboratory strategic planning, served as the laboratories’ congressional liaison, and managed scientific and technical publications and journals. She has an MS in Science Communications from Rensselaer Polytechnic Institute and a BS in Geology from Iowa State University.

Tom Karas is a member of the Strategic Studies group. Earlier, he was in the Sandia Advanced Concepts Group for 8 years, during which he studied, among many other things, energy policy issues. His BA in Political Science is from Yale, PhD in Political Science from Harvard.



# AML GRAD STUDENT PRESENTATIONS & TOURS

## **Synthesis of Novel Self-Assembled Porphyrin Nanostructures**

John Jacobsen, Jim Miller and John Shelnutt

We have recently reported that ionic self-assembly of two *meso* substituted porphyrins produces nanotubes approximately 50 nm in diameter and 400 nm long (Wang et al., *J. Am. Chem. Soc.* **2004**, *126*, 15954). Currently, we are investigating the internal structure of these remarkable materials as well as their mechanism of formation. My talk will describe recent studies of the nanotubes (TEM, UV-Vis, Raman, electrical conductivity). I will also discuss the synthesis of novel porphyrins for use in the self-assembly reactions and show other self-assembled porphyrin nanostructures that have now been prepared.

## **Interfacial Property Control Elastomeric Nanocomposites**

Norma J. Wells, Timothy J. Boyle, Timothy L. Ward, Bernadette Hernandez-Sanchez, Timothy N. Lambert, and Shailendra B. Rathod

The interaction between elastomers and nanocomposites is not yet understood, however there is great interest in learning how nanocomposites can either improve or degrade an elastomeric material. The first step in this process is engineering the nanocomposites. Using aerosol spray pyrolysis, solvothermal, and solution precipitation methods aluminum nanoparticles with varying morphologies have been made. More work stills needs to be done for size and shape improvements. Also future work will include looking at other metal combinations of nanocomposites to see any similarities or differences to the aluminum nanocomposites.

## **Self Assembled Templating for Low Cost Solar Cells**

Steven Gaik

Recent studies and experimental evidence have suggested high solar cell efficiencies are attainable from nanostructured devices exhibiting quantum confinement. Using self-assembling sol-gel chemistry, the Hillhouse research group at Purdue University has developed a simple, low-cost approach for producing quantum confined, double-gyroid templated solar cells. Recent work has focused on identifying suitable solvents, surfactants, and precursors to accommodate an alternative solvent extraction step. Solvent extraction is expected to eliminate film cracking and destructive high temperatures encountered in the current synthesis approach.

## **Modeling Conformal Growth in Photonic Crystals**

Andrew Brzezinski

Photonic crystal templates fabricated by interference lithography form a complex and periodic series of surfaces and pores in three dimensional space. The structure can be described by a sum of sinusoidal terms. However, upon infilling the template with a dielectric material via atomic layer deposition the structure can not be described with a simple mathematical function. We have developed a method to model the conformal growth of material inside periodic templates that takes into account the effects of pore pinch-off, periodicity, and surface termination. It is shown how the effect of the template plus the conformal growth affects the photonic properties of the final structure. Our model allows us to properly account for the effect of conformal growth in the design of photonic crystals.



# AML GRAD STUDENT PRESENTATIONS & TOURS

## **Chemically Modified Graphene Sheets**

Sungjin Park and Rodney S. Ruoff\*

For the last decade, graphene-based materials have been intensively investigated due to the excellent mechanical and electrical properties that the graphene sheet was predicted to possess. Successful production of individual graphene sheets has been reported by several techniques including the scotch tape (peel off) method, epitaxial growth, noncovalent functionalization of graphite and chemical reduction of graphene oxide suspension which can be obtained by simple sonication of graphite oxide (GO). Of these, the route *via* the graphene oxide sheets in suspension to obtain individual graphene sheets has been one of the most versatile and easily scalable methods. Chemical reactions with the oxygen functionalities on the graphene oxide sheets have been a good way to modulate the properties of individual graphene sheets and graphene-based macroscopic materials. Here, I will present details concerning the chemical modification of graphene oxide sheets and their potential use as additives to elastomer solutions to influence their mechanical properties.



# CINT GRAD STUDENT PRESENTATIONS & TOURS

## **In-Situ Probing of Epitaxially Aligned GaN Nanowires through Nanomanipulation**

Tania Henry

Self alignment and positioning of nanowires in-situ is the first step towards overcoming the challenge of random positioning and orientation of nanowires for nanowire device fabrication and integration. Successful integration however, comes with grasping the fundamental mechanisms governing transport, and a thorough understanding of device functionality. As the popularity of nanoscale devices increases, the need for suitable characterization and manipulation tools becomes important. The electrical properties of single epitaxially aligned gallium nitride (GaN) nanowires were investigated using nanomanipulation in a SEM/STM tool. Nanomanipulation allows easy access to individual nanowires without the need for optical or e-beam fabricated contacts. This approach permits the extraction of the intrinsic properties of the nanowires and gives insight into the electrical conduction mechanisms taking place.

A combination of non-linear current-voltage (I-V) characteristics along with Schottky diodes were realized using this approach. This allows us to extract nanowire properties such as the resistivity and Schottky barrier height.

## **In-Situ Deformation of Nanostructures**

Junhang Luo

In recent years, nanostructures such as nanowires (NWs) and nanotubes have received increased attention as building blocks for future nanoscale devices. Owing to their small length scale and high surface area/volume ratio, nanostructures exhibit unique mechanical properties as compared with bulk materials. But most results are come from the molecular dynamics (MD) simulations and few experimental studies were carried out due to the difficulties of sample preparation. There still exists a large gap between the structure and the properties of nanoscale materials. We intent to bridge the gap by conducting the simultaneous structure and property studies of individual nanostructures.



# MESA GRAD STUDENT PRESENTATIONS & TOURS

## **Measuring Particle and Cell-Surface Interaction Forces on the Femto-Newton Scale**

Matt Reichert

## **Engineering Systems for Cold Atom Research**

Thomas Loyd

I will present an introduction to the tools used in cold atom research. These include laser cooling, magneto-optical trapping, and magnetic trapping. I will also give an overview of Sandia's neutral atom experiment by describing the atom chip itself as well as the electronic, laser, and vacuum systems involved.

## **Failure Analysis Lab Tour**

Shawn Levesque

