K-State ADVANCE Institutional Transformation

ADVANCE Workshop:
Women in Science and Engineering

February 15-16, 2008

Student Union
Kansas State University
Manhattan, Kansas 66506 USA

Supported by:
The National Science Foundation*
Kansas State ADVANCE program
Women in Science and Engineering Program
Kansas State's Academic Departments and Divisions:
Division of **Biology**, Department of **Biochemistry**, Department of **Chemistry**, Department of **Physics**, and Department of **Chemical Engineering**

February 13, 2008

Dear Participants,

In keeping with Kansas State University's continuing efforts to improve the climate for women in the sciences and engineering, it is our pleasure to welcome you this ADVANCE Workshop on Women in Science and Engineering at Kansas State University. We hope this event will provide a forum in which to discuss the challenges that face academic women in science, technology, engineering and mathematics throughout their careers. We will also highlight the successful strategies that have been employed to improve the climate for women in these disciplines, and call for action at K-State to implement policies that will continue to improve the climate here. We are especially excited to bring many illustrious female scientists to campus to discuss these issues and their personal experiences and research with us. We are also delighted to present the work of female scientists and postdocs at K-State, highlighting the important scientific contributions of women on campus. We welcome the participation of men and women, scientists and social scientists, as we look and move forward. Thank you for participating in this important effort.

We are very grateful for the support that has made this event possible. Significant financial support has been provided by the ADVANCE program at Kansas State. In addition, many academic departments have provided funding, including the Division of Biology, the Department of Biochemistry, the Department of Chemistry, the Department of Physics, and the Department of Chemical Engineering. Furthermore, the Women in Science and Engineering Program (WESP) office has provided essential organizational support. We especially thank Kim Coy and Jane Peterson in the Physics Department, and Mahjabeen Raza at WESP for their organizational efforts.

Yours Sincerely,

Kristan L. Corwin
Assistant Professor of Physics
Kansas State University

Talat S. Rahman
Department Chair
University of Central Florida

ADVANCE Workshop: Women in Science and Engineering

February 15-16, 2008 Kansas State Student Union

Schedule of events

Friday night:	(**Flint Hills Room**, Kansas State Student Union)
7:30 – 8:30 pm	Public Lecture: *Ellen Williams, "Seeing Atoms: The Beginnings of Nanoscience"*
8:30 – 9:30 pm	Public Reception

Saturday:	(**Big 12 Room**, Student Union, unless otherwise noted)
8:30 – 8:35 am	Welcoming remarks: *Kristan Corwin, Dean Zollman, and Talat Rahman*
8:35 – 10:15 am	Panel 1: Some hurdles in the professoriate. Moderator: *Beth Montelone* Speakers: *Danielle Braje, Meera Chandrashekar, Jacqueline Spears, and Ellen Williams*
10:15 – 10:45 am	Coffee and donut break
10:45 am– 12 pm	Panel 2: What the numbers tell us. Moderator: *Angela Hubler* Presentation: *Talat Rahman for Rachel Ivie, and with Kathy Levin*
12:15 – 1:15 pm	Lunch (**Flint Hills Room**, Kansas State Student Union)
1:15 – 3:00 pm	Panel 3: Some best practices in the professoriate; Moderator: *Mary Rezac* Speakers: *Sherry Yenello, Shireen Adenwalla, Kristine Lang, and Angela Hubler*
3:00 – 4:30 pm	Poster session (**2nd floor concourse,** Student Union)
4:30 – 6:00 pm	Workshop Summary and Plan of action
7:30 pm	Potluck Dinner and party: 2351 Grandview Terrace Please bring a dish, if possible.

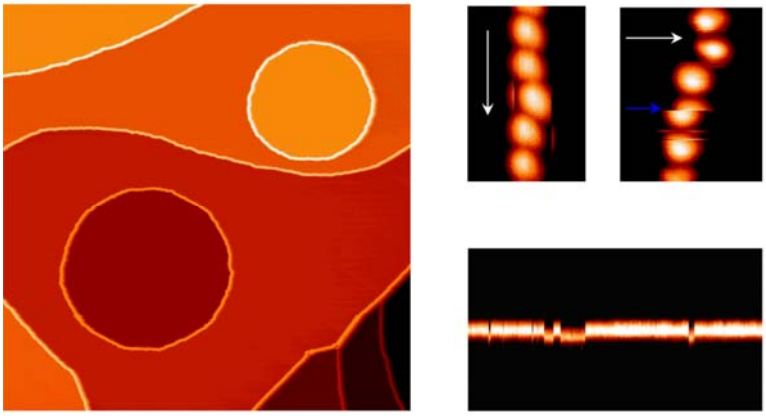
A lecture open to the public:

Seeing Atoms: The Beginnings of Nanoscience

by **Ellen D. Williams**
Distinguished University Professor
edw@umd.edu, Department of Physics, University of Maryland

7:30 pm Friday Feb. 15th
Flint Hills Room, Student Union, Kansas State University

Keynote address for the ADVANCE workshop in Women in Science and Engineering
www.phys.ksu.edu/advance



Twenty-five years ago, the invention of a new scientific instrument, the scanning tunneling microscope, created a scientific revolution allowing scientists to visualize and even manipulate individual atoms. The new capability, and the new perspectives that followed from its use, led to the new discipline of nanoscience and its attendant applications in nanotechnology. Nanoscience is the study of materials with nanometer scale structure - however the nanoscale world is not a scaled-down version of the macroscopic world. Nanoscale structures have special properties by virtue of their smallness alone, which include quantum confinement, high surface-to-volume ratio and susceptibility to fluctuations.

In this talk, I will discuss the discovery and development of scanning tunneling microscopy, and show its use in observing individual atoms moving in nanoscale structures. I will discuss the connection to electronic devices, where the junctions that control device performance are reaching nanoscale size. The seemingly random motion of atoms at such nanoscale junctions will create specific signatures and behaviors more similar to signal transmission in biology than in traditional solid-state electronics.

In addition to discussing my research in seeing atoms, I will discuss impact of changing attitudes in women's participation in science on my career. When I began graduate school at Caltech, formal admission of women had only been allowed there for a few years.

Acknowledgment

* Support for this work has been provided by the NSF-MRSEC and the Laboratory for Physical Science, NIST, and the UMD-CNAM.

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Biosketches of some panelists

Danielle Braje is a guest researcher at the National Institute of Standards and Technology (NIST) in Boulder, CO. She received her Ph.D. in Applied Physics from Stanford University working with Dr. Steve Harris. Her thesis work centered around electromagnetically induced transparency in cold-atoms, ultimately generating correlated photon pairs. After a postdoctoral / Urbanic Fellowship at Stanford University, Dr. Braje accepted an assistant professorship at Reed College, in Portland, OR, spending a year teaching, mentoring students, and building a laboratory before moving to NIST.

Dr. Braje obtained her undergraduate degree in physics from the University of Arizona, and had a wide range of experiences in different environments from NASA Goddard Space Flight Center to Lund University in Sweden. Throughout her career, she has continued in a field she loves, attempting to overcome the gender barriers and striving to be a leader by example, in discussions, and in mentoring. She believes that change happens slowly by including both genders in the process.

Dr. Braje's Research interests include quantum coherence effects, nonlinear optics, atomic physics, electromagnetically induced transparency, and recent work in frequency combs.

Meera Chandrasekhar received an M.Sc. from the Indian Institute of Technology in Madras, India, and a Ph. D. from Brown University, Providence R.I. (1976). After a post doctoral fellowship at Max-Planck-Institut in Stuttgart, W. Germany, she came to the University of Missouri, Columbia in 1978, where she is currently Curators' Teaching Professor of Physics.

Dr. Chandrasekhar's research interests are in the area of optical spectroscopy of semiconductors, superconductors, and conjugated polymers, with an emphasis on high pressure studies. She has a strong interest in the education of young students, and has developed hands-on physics programs for students in grades 5-12, and summer institutes for K-12 teachers. She has received several awards for these activities, including NSF's Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring.

Prof. Chandrasekhar is a co-PI on the University of Missouri's Mizzou ADVANCE project, funded by the NSF. She chairs the STRIDE committee, the goal of which is to raise awareness at MU about the practices and policies necessary to change MU culture to promote the advancement of STEM faculty without regard to gender. STRIDE is a committee of 10 professors and administrators who are trained in practices that increase the promotion and success of women faculty. Members share their knowledge with chairs, administrators, search committees, and promotion committees. STRIDE is modeled after a successful program at the University of Michigan.

She is the Higher Education PI on an educational project, entitled "A TIME for Physics First," funded by a Mathematics and Science Partnership grant from the Missouri Department of Elementary and Secondary Education. This project is a partnership among several Missouri School Districts, the University of Missouri and Missouri State University. The project is formulated with the immediate (3-year) goal of designing and implementing a professional development curriculum for teachers to teach Physics First in 9th grade classrooms.

Kristine Lang grew up in Colorado Springs, CO where she earned the scorn of her high school peers by reading physics books during the basketball games she was required to attend for band. Despite this early interest, for her undergraduate degree she attended Georgetown University where she majored in International Relations. Realizing the error of her ways, she applied and was miraculously admitted to

U.C. Berkeley despite her lack of physics background from college. After seven long but fun years she was awarded her Ph.D. in Physics in 2001. During her time at Berkeley she founded and ran an organization called the Society for Women in the Physical Sciences, which sponsored social and mentoring activities for the women in Physics, Astronomy and Geology at Berkeley. More than ten years after its founding, the group is still going strong sponsoring regular activities for women in the sciences on the Berkeley campus.

After finishing graduate school, Kristine was a postdoc for 1.5 years at the National Institute for Standards and Technology in Boulder, CO. Since fall 2003 she has been an Assistant Professor at Colorado College in Colorado Springs where she teaches and does research. For her research she uses scanning tunneling microscopy to study materials used in quantum and classical computation. She is happy to have returned home to Colorado Springs to live near her family, especially since in May 2006 she became a mother to her son Cooper. Coming full circle, Kristine recently spoke at Berkeley for one of the Society for Women events discussing the balance she has found between family and career.

Jackie Spears is K-State's Director for the Center for Science Education. She is currently Associate Professor of Secondary Education and served as the Director of the Women's Studies Program from 1998 to 2003. Jackie received both a B.S. and M.S. in Physics from K-State as well as a Ph.D. in Curriculum and Instruction. Jackie has had numerous projects funded by federal agencies and private foundations, most notably the U.S. Department of Education, National Science Foundation, Ford Foundation, MacArthur Foundation, and Annenberg/CPB Project. Her current research focuses on diversity issues in math and science education as well as school-university linkages. Jackie served as Chair of the Faculty Senate Academic Affairs Committee as well as Faculty Senate President.

Ellen D. Williams received her undergraduate degree from Michigan State University in 1976, and her Ph.D. in Chemistry from Caltech in 1981. She began as a post-doctoral fellow in Physics at the University of Maryland in 1981, and has risen through the ranks to become Distinguished University Professor of Physics. She founded the University's NSF-supported Materials Research Science and Engineering Center, and has served as its director since 1996.

Professor Williams's research is in surface physics. The objective of her research group is to develop practical capabilities for characterizing and predicting the evolution of materials structures on nanometer to micron length scales. Most recently she has focused on the impact of structural fluctuations on the performance of nanostructures. She was awarded the APS David Adler Lectureship Award in 2001. She was a Japan Society for the Promotion of Science Fellow in 1996, and was the recipient of the E. W. Mueller Award of the University of Wisconsin in 1996. She was the recipient of the APS Maria Goeppert-Mayer Award in 1990. She is a fellow of the APS and of the American Vacuum Society, and was an Office of Naval Research Young Investigator in 1986-89, and a Presidential Young Investigator in 1984-89.

Sherry Yennello is a Regents Professor of Chemistry and the Associate Dean for Diversity in the College of Science at Texas A&M University. She has served as the chair of the APS CSWP. She has also served on the organizing committee for the Gender Equity in Physics Workshop that took place last May for department chairs and division leaders.

Dr Yennello's research is in the area of Nuclear Dynamics and Thermodynamics. She has been recognized with many awards and is a Fellow of the APS.

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Contributed Poster Abstracts

1.	Anis, Fatima	The Role of Molecular Rotation for H_2^+ and its Isotopes in Intense, SUB-10 fs Laser Pulses
2.	Bocharova, Irina	Study of H_2 Molecular Dynamics in Strong Laser Field using Coulomb Explosion Emaging
3.	Forbes, Safiyyah	Co-crystals: A New Approach in the Development of Active Pharmaceutical Ingredients
4.	Gilbertson, S. Eli	Aerosol Gel Production from Liquid Phase Precursors
5.	Gomez, Lorena	Soil Metagenomics to Identify Indicators of Soil Degradation in the Bolivian Highlands
6.	Haynicz, Jacquelyn J.	Students' Ideas of a Blender and Perceptions of Scaffolding Activities
7.	Mateycik, Fran	Students' Perceptions of Case-Reuse Problem Solving in Algebra-Based Physics
8.	McBride, Dyan L.	Investigating Student Resources for Understanding Wavefront Aberrometry
9.	Ray, Dipanwita	Large-Angle Electron Diffraction Structure in Laser-Induced Rescattering from Rare Gases
10.	Smith, Michelle	Ditopic Ligands in A World Where Discrimination is Desirable: Studies in Organic Cocrystal Syntheses
11.	Sun, Xin	Role of the Solvent in Directing the Self-assembly Synthesis of Nanoporous Materials
12.	Thilani, Samarakoon	Supra Molecular 2,3-Dihydro-1H-Benzo[d]imidazole and Zinc(II)Dichloride Complexes as Agents in Photodynamic Therapy
13.	Viberg, Pernilla	Culturing of Non-adherent Non-anchored Leukemia Cells on a Microfluidic Device
14.	Wu, Shun	Growth and Applications of Carbon Nanotubes and Quantum Dots for Biological and Chemical Sensing
15.	Yao, Xiao	Multiphoton Lithography

1 The Role of Molecular Rotation for H_2^+ and its Isotopes in Intense, SUB-10 fs Laser Pulses.* Fatima Anis and B. D. Esry, *J.R. Macdonald Laboratory and Department of Physics Kansas State University, Manhattan, KS*

By including nuclear rotation in our solution of the time-dependent Schrödinger equation for H_2^+ and D_2^+ in an intense laser pulse, we show that alignment effects are important even for sub-10 fs pulses. We will explore the interplay of nuclear rotation and vibration, along with electronic excitation, on the dynamics of these ions. Both the bound and dissociating molecules evolve freely after the pulse. Bound molecules show clear revival structures — vibrational as well as rotational — while dissociating molecules evolve to align the fragments along the laser polarization. We will present results of post-pulse dynamics for both the bound and dissociating molecule. We will also present results for a broad range of intensities, comparing them with those obtained from the standard field-aligned, two channel model that neglects rotation.

Work supported by the Chemical Sciences, Geosciences, and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U.S. Department of Energy.

2 Study of H_2 Molecular Dynamics in Strong Laser Field using Coulomb Explosion Emaging. Irina Bocharova, Dipanwita Ray, Predrag Ranitovic, Lewis Cocke and Igor Litvinyuk, *Kansas State University, JRM, Department of Physics*

The availability of femtosecond laser pulses of high intensity in combination with Coulomb explosion imaging and COLTRIMS technique allow us to study fast processes inside of small molecules like hydrogen. In our experiment we initiate two kind of processes – rotation and vibration – focusing a pulsed laser beam inside the jet of neutral molecules. The next laser pulse breaks the molecule apart. Our technique is employed to collect all the molecular fragments and information about them which is enough to recover molecular structure at the moment of explosion. Breaking rotating and vibrating hydrogen molecule at different times after the process is initiated allow us to follow the dynamics of this process.

3 Co-crystals: A New Approach in the Development of Active Pharmaceutical Ingredients. Safiyyah Forbes, Christer B. Aakeröy, John Desper, *Kansas State University, Department of Chemistry*

Crystal engineering have recently being used as a way of tailoring the physiochemical properties of active pharmaceutical ingredients (API's). The majority of API's exist in a variety of crystalline forms (polymorphs, salts, solvates) because of the inherent physico-chemical stability of crystalline materials. However, some API's display unwanted physical properties such as poor solubility/dissolution rate or thermal stability. With the use of pharmaceutical co-crystals a given API can be incorporated with another pharmaceutically acceptable molecule in the crystal lattice, which may improve the solubility, melting point and physical stability of the drug. Syntheses and crystal structures of several co-crystals of a family of anti-tumor API's prepared with acceptable carboxylic acids, amides, oximes and alcohols, are presented in this contribution. Intermolecular interaction-preferences are identified and rationalized based upon simple electrostatic principles of molecular recognition.

4 Aerosol Gel Production from Liquid Phase Precursors. S.E Gilbertson, R. Dhaubhadel, C.M. Sorensen, *Kansas State University, Department of Physics*

Considerable work has been conducted on the production of aerosol gel production via gas phase precursors. Yet, the results only give us a limited knowledge of gel morphology and the appropriate conditions of gelation. By expanding this exploration to liquid phase precursors, we open the door to many more materials, applications, and synthesis techniques, as well as broaden our understanding of science.

5 Soil Metagenomics to Identify Indicators of Soil Degradation in the Bolivian Highlands.* Lorena Gomez, Ari Jumpponen[1], Michael Herman,[1] and Karen A. Garrett, *Kansas State University, Department of Plant Pathology and* [1]*Division of Biology*

The Bolivian highlands (approximately 4000 masl) are experiencing changes in agricultural practices due in part to climate change and economic pressures. Traditional fallow periods are being shortened in an effort to increase yield, but this may be at the expense of soil quality. We will study soil microbial metagenomics using pyrosequencing methods, which allow us to place hundreds of thousands of individual microbes in taxonomic categories. Our goal is to identify microbes that may serve as indicators for the process of soil degradation and to understand the response of soil microbial communities to changing land management practices.

[*]This work is funded in part by the USAID for the SANREM CRSP, Award No. EPP-A-00-04-00013-00 to the OIRED at Virginia Tech.

6 Students' Ideas of a Blender and Perceptions of Scaffolding Activities. Jacquelyn J. Haynicz and N. Sanjay Rebello, *Kansas State University, Department of Physics*

Research has shown that students can be motivated to learn science by demonstrating its connection to everyday life. We investigated students' understanding of an everyday blender. We have previously reported on students' progression through a series of hands-on activities designed to facilitate learning about how the blender works. Here, we report on the ideas about the blender expressed by students after completing the sequence of activities and the students' perceptions of the activities themselves.

[*]This work is funded in part by the NSF grant REC-0133621.

7 Students' Perceptions of Case-Reuse Problem Solving in Algebra-Based Physics* Fran Mateycik[1], Zdeslav Hrepic[2], David Jonassen[3], N. Sanjay Rebello[1], *[1]Kansas State University, Department of Physics, [2]Fort Hays State University, [3]University of Missouri*

Problem solving is an important goal in almost all physics classes. In this study we explore students' perception and understanding of the purpose of two different problem solving approaches. In Phase I of the study, introductory algebra-based physics students were given an online extra credit problem-solving assignment. They were randomly assigned one of three problem-solving strategies: questioning, structure mapping, and traditional problem solving. In Phase II of the study, eight student volunteers were individually assigned to work problems using one of the strategies in two sessions of semi-structured interviews. The first session investigated students' general problem solving approaches a few weeks after they had completed the online extra-credit assignment. The second session investigated students' perceptions of problem solving strategies and how they relate to the extra credit assignments. This poster describes students' perceptions of the purpose of the activities and their underlying problem solving techniques.

[*]This work is funded in part by the National Science Foundation under grant DUE – 06185459

8 Investigating Student Resources for Understanding Wavefront Aberrometry.* Dyan L. McBride and Dean A. Zollman, *Kansas State University, Department of Physics*

We describe a qualitative study of student understanding of the functions of the human eye and the resources used in understanding wavefront aberrometry, a relatively new method of diagnosing vision defects. Twelve students enrolled in an introductory physics class participated in a semi-structured interview discussing functions of the eye, traditional diagnosis methods such as the eye chart, and wavefront aberrometry. Results from this study

indicate that students do not initially understand the subjective nature of traditional diagnosis techniques and that the use of physical models of the eye and aberrometer can facilitate the transfer of prior knowledge to these concepts.

* This worked supported by the National Science Foundation under grant DUE 04-26754.

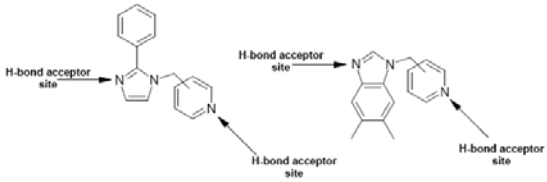
9 Large-Angle Electron Diffraction Structure in Laser-Induced Rescattering from Rare Gases. D. Ray[1], B. Ulrich[2], I. Bocharova[1], C. Maharjan[1], P. Ranitovic[1], B. Gramkow[1], M. Magrakvelidze[1], S. De[1], I.V. Litvinyuk[1], A.T. Le[1], T. Morishita[1,3], C.D. Lin[1], G.G. Paulus[4] and C.L. Cocke[1], [1]*J. R. Macdonald Laboratory, Physics Department, Kansas State University, Manhattan, KS 66506,* [2]*Institut für Kernphysik, University Frankfurt, Frankfurt Germany,* [3]*Dept. of Applied Physics and Chemistry, The University of Electro-communications, Tokyo Japan,* [4]*Institute of Optics and Quantum Electronics, Jena, Germany*

We have measured full momentum images of electron rescatterred from Xe, Kr and Ar following the liberation of the electrons from these atoms by short, intense laser pulse.

Structural study of transient target atoms (or molecules) can be done by focusing on the high energy backscattered electrons in such laser-matter interactions. Recent theoretical developments show that full solutions to time-dependant Schrodinger equation including rescatttering allow the identification of specific "back rescattering ridges" (BRR) along which the angular structure of the differential cross section is clearly visible and very target dependant. We experimentally observed these predicted features in the momentum images.

10 Ditopic Ligands in A World Where Discrimination is Desirable: Studies in Organic Cocrystal Syntheses. Michelle Smith , Christer B Aakeröy, and John Desper, *Kansas State University, Department of Chemistry*

A series of ditopic ligands have been synthesized equipped with two different hydrogen bond acceptor sites. These two sites are subtle in their differences, being geometrically similar, but electrostatically very different. In order to answer the question as to whether it is possible for a hydrogen bond donor such as a carboxylic acid or an oxime to be able to distinguish between, and hence discriminate against, one binding site over the other, cocrystallization experiments, X-ray crystallography, and a series of electrostatic surface potential calculations have been performed and are employed as tools in the study of these supramolecular reagents.



11 Role of the Solvent in Directing the Self-assembly Synthesis of Nanoporous Materials. Xin Sun, Jonathan King, and Jennifer L. Anthony, *Kansas State University, Department of Chemical Engineering*

Molecular sieves have been known and synthesized for over 200 years, but their crystallization mechanisms are still not fully understood by researchers, although some theories have been suggested. In order to better understand the crystallization mechanisms, our group is investigating the role of solvents in directing the self-assembly of molecular sieves. We have used several ionic liquids and molten salts as both the solvent and the SDAs. We are currently working on investigating the relationship between the equilibrium solubility of the precursors and the formation of the material.

12 Supra Molecular 2,3-Dihydro-1H-Benzo[d]imidazole and Zinc(II)Dichloride Complexes as Agents in Photodynamic Therapy. Samarakoon N. Thilani, Bossmann H. Stefan, *Kansas State University, Department of Chemistry*

The research on anti cancer drugs has expanded immensely over the years. Scientists seek for new drugs which are effective and affordable. Every drug has its unique way of fighting with cancer cells.

Preliminary research has shown that 1:1 mixture of 2,3-dihydro-1H-benzo[d]imidazole and Zinc(II) dichloride can efficiently kill cancer cells when irradiated at 313nm. The poster will further explain the proposed mechanism to explain this phenomena.

Binding of different substituents of 2,3-dihydro-1H-benzo[d]imidazole is studied using Fluorescence, UV absorption and NMR methods. This will help to study the electronic and steric factors influencing the DNA binding.

13 Culturing of Non-adherent Non-anchored Leukemia Cells on a Microfluidic Device. Pernilla Viberg, *Kansas State University, Department of Chemistry*

We have cultured single non-adherent neither anchorage-dependent Leukemia cells in a cell culture chamber for 12h with a viability rate of 92% and apoptosis of 2.8%. For decades cell culturing has been performed in cell culture flask or dishes. Here we study cells in a microenvironment, to mimic the environment of cells *in vivo*. Cancerous cells have high heterogeneity throughout the cell cycle, this platform allows studies of cells specifically the G1 phase of the cell cycle. Our goal is to perform a single cell analysis, were we break the cell membrane and study to study the cell signaling system. This research is sponsored by the National Institute of Health.

14 Growth and Applications of Carbon Nanotubes and Quantum Dots for Biological and Chemical Sensing.[*] Shun Wu, Vijaya K. Kayastha, Yoke K. Yap**,** *Michigan Technological University, Department of Physics*

Downsizing electronic devices is one of the major challenges for next generation technology. Carbon nanotubes and quantum dots are both unique nano-structures with remarkable properties, which make them promising candidates for ultra-small-sized electronics. In this project, the growth of carbon nanotubes and quantum dots by thermal Chemical Vapor Deposition (CVD) method are explored. Their future applications of in biological and chemical sensing are also investigated.

[*]*This work is funded in part by the U.S. Department of Army under grant number W911NF-04-1-0029 through the City College of New York, Defense Advanced Research Agency (Contract No. DAAD17-03-C-0115, through Army Research Laboratory), and the Center for Nanophase Materials Sciences sponsored by the Division of Materials Sciences and Engineering, U.S. Department of Energy (Contract No. DEAC05- 00OR22725 with UTsBattelle, LLC.).*

15 Multiphoton Lithography. Xiao Yao, Daniel A. Higgins, *Kansas State University, Department of Chemistry*

Lithography techniques have been widely used to fabricate all kinds of optical, microelectronic and optoelectronic devices in the sub-micrometer size range. The resolution depends on the chemical/physical steps involved, the quality of the patterns, and the diffraction of the light on the substrates. Due to these limitations, we have been investigating a direct-write multiphoton lithography as analternative. Ultra short pulsed laser light in the near-IR is focused into polymer film, binary and grayscale structures have been produced by modulating the focus following the power dependence study which is based on a simple kinetic model.