NEW IUSL DEPUTY DIRECTOR

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MBA as well as a Ph.D. in physics, was instrumental in the daily operations of the IUSL and its expansion into electrical engineering.

"His business and organizational skills were key elements in establishing the IUSL as the principal research arm in photonics at CCNY and throughout The City University," Dr. Alfano said.

Dr. Ho also played a major role in developing CUNY's New York State Center for Advanced Technology in Ultrafast Photonics, which is headquartered at CCNY and promotes economic development in New York State by generating and disseminating knowledge in photonics technology. Dr. Alfano heads the CUNY-CAT.

Since it was established at CCNY over two decades ago, the IUSL has become world renowned as the pioneering laboratory in promoting multidisciplinary research and education in photonic and laser technologies for scientific, engineering, medical and industrial applications.

IUSL scientists have conducted ground-breaking basic and applied photonic research in the areas of laser imaging and medical diagnosis, tunable solid-state lasers and amplifiers, semiconductors, organic-inorganic hybrid nanoscale materials, terahertz spectroscopy and nonlinear optics.

Dr. Zevallos came to the U.S. from his native Ecuador in 1984, at the age of 19.

"I came to America with one goal in mind: to get a doctorate." He said. "At the time my dream was to become a scientist, join NASA and eventually become an Astronaut."

While he hasn't become an Astronaut, Dr. Zevallos did get his Ph.D. with the help of a NASA Institutional Research Award grant. Today, he is a Senior Scientist at the IUSL and also coordinates CCNY's NASA Center for Optical Sensing and Imaging, which was established under a five-year $6 million grant from the National Aeronautics and Space Administration. The Center's mission is to develop enabling optical technologies, laser instrumentation and methods for sensing and imaging of the Earth and the environment. It is also designed to recruit and train underrepresented minority students to enter these fields.

"I am very proud to be part of such an important NASA program," Dr. Zevallos said.

As Deputy Director of the IUSL he will help run an Institute that attracts faculty, senior research scientists, postdoctoral research associates and visiting scholars from around the globe, as well as outstanding graduate and undergraduate students from CCNY's departments of physics, chemistry, biology, chemical engineering, computer science, earth and atmospheric sciences and electrical engineering.

Dr. Zevallos's road to success was not easy. Although he graduated from a prestigious high school in Ecuador, he did not speak English. So the best he could do after arriving in the U.S. was to obtain a job in a pen factory. The work was hard and long, "lifting and moving cartons, standing in front of a machine to remove pens that had just passed through a hot oven, using bare hands to place a new batch of pen caps on hot spindle carriers, and burning my fingers when I made a mistake."

So he saved his money and enrolled in an intensive English program at the Spanish American Institute (SAI). Weekdays he would wake up at six o'clock, put in a full day at the factory, then head straight to classes at the SAI, returning home at 11 p.m.

After 10 months he left the pen factory for a job as a parking attendant. After finishing the English course he decided to enroll at CCNY because of its affordability and outstanding reputation in the sciences. He worked around fifty hours a week as a parking attendant during his first semester. In his junior year he got a job as a College Work Study student, working 15 to 20 hours per week in CCNY's physics department labs, which enabled him to reduce his hours at the garage to 30 per week.

He did well in laboratory research and Dr. Alfano, who is also Distinguished Professor of Science and Engineering, recommended him for an NSF fellowship with the Center for the Analysis of Structures and Interfaces, another of CCNY's leading-edge research organizations, headed by Professor Daniel Akins. Dr. Zevallos received the award and Professor Alfano became his mentor.

Dr. Zevallos became an American citizen in 1991. He received his B.E. and M.E. degrees from CCNY in 1992 and 1996, respectively. In 1999, he earned his doctorate in electrical engineering from the CUNY Graduate Center while working at the IUSL. His Ph.D. research was entitled *NIR Optical Imaging and Light Propagation in Highly Scattering Random Media*.

In February 1999 Dr. Zevallos became a Scientist/Staff Engineer in IBM's Thin Film Microelectronics Division at Fishkill, NY. Three years later he returned to CCNY as a Senior Scientist at the IUSL, and last year he was named Technical and Administrative Coordinator for NASA-COSI.

Dr. Zevallos's research interests are in Biomedical Optical Imaging, and the Applied Optics and Lasers arena in general.

"Through all the hard work and struggles my dreams have kept me going," he said. "City College, NASA and the IUSL helped me fulfill my dreams. I also appreciate the support of my family, friends and mentors who have had faith in me and given me encouragement." ■

Editor: Charles DeCicco. Designer: Lauren Gohara

The IUSL Report

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Save This Date!

Physics Department Homecoming

-- March 11, 2005 --

The first annual *City College Physics Department Homecoming* is being held on Friday, March 11, 2005, at the Robert E. Marshak Science Building, located at 138th Street and Convent Avenue. The homecoming will include tours of the CCNY physics facilities, lectures, opportunities to meet faculty and students, and a luncheon.

For more information, please contact: Sue Turner at (212) 650-5516 or sueturn@sci.ccny.cuny.edu.

AGENDA

9:30 am	Coffee Hour
10:30 am	Welcome - Michael Lubell and Myriam Sarachik
11:00 am	Speaker - Michio Kaku, "CCNY and the Theory of Everything"
12:30 pm	Luncheon
2:00 pm	Lab Tours Low Temperature Lasers Microwave Imaging Biophysics NMR facility
3:15 pm	Meet the Faculty
4:00 pm	Talk - Peter Delfyett, "Ultrafast Modelocked Semiconductor Lasers -- Physics & Applications"
5:00 pm	Closing Remarks - Dean of Science, Maria Tamargo.

CCNY Research Center Helps Keep U.S. at Forefront in Combining Photonics and Nanotechnology

Photonics-based nanorobots -- so tiny they are invisible to the human eye -- might one-day diagnose and treat diseases like cancer and perform delicate surgery within blood vessels. Molecular optical-based computers with storage devices holding trillions of bytes of information may eliminate worry in the computer industry over limits in the number of transistors that can fit on microprocessors.

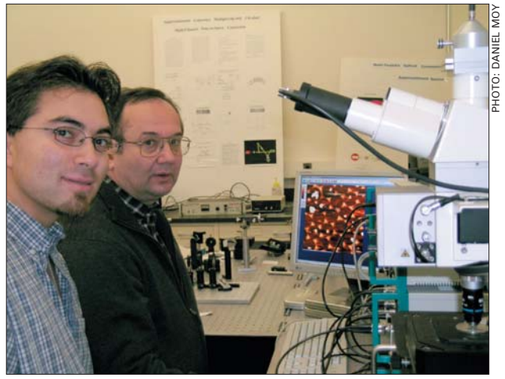

PHOTO: DANIEL MOY

Senior IUSL research associate Dr. Joseph Zeylikovich (right) and graduate student Alejandro Victoria examine a nanoscale image using an Atomic Force Microscope with a resolution of 6 nanometers.

Those are some possible outgrowths of research in nanotechnology and photonics being conducted by scientists at the Department of Defense Center for Nanoscale Photonic Emitters and Sensors, located at The City College of New York/CUNY. The DoD Center will focus on new approaches to sensing utilizing novel sources and detectors based on nanoscale technology.

Nanoscale devices should eventually have an impact on biological and medical sensing.

Some scientists believe nanotechnology will have the same revolutionary impact in the 21st Century that the development of microchips and computers had in the 20th Century. That is why, under a National Nanotechnology Initiative that began four years ago,

Continued on page 2

Manuel Zevallos Named Deputy Director of IUSL

Dr. Manuel Zevallos has been named Deputy Director of City College's Institute for Ultrafast Spectroscopy and Lasers, it was announced by Professor Robert R. Alfano, Director of the IUSL. He succeeds Professor Ping-Pei Ho, who has decided to pursue other professional activities and interests. Dr. Zevallos will continue to serve as Technical and Administrative Coordinator of CCNY's NASA Center for Optical Sensing and Imaging.

"I wish to thank Dr. Ho for his years of dedicated and valuable service and look forward to continuing research collaboration with him as a member of the IUSL research team," Dr. Alfano said. Dr. Ho, who has an

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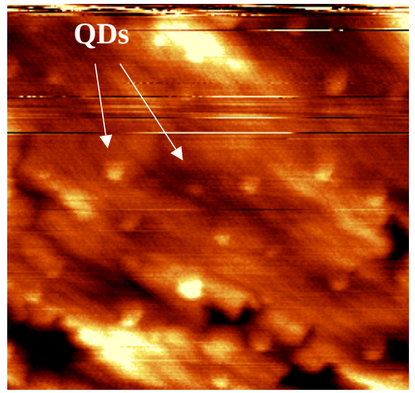
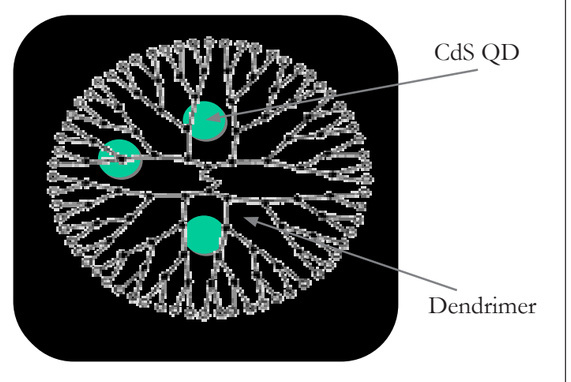
C UNYITE crystals (Cr^{4+}: Ca_2GeO_4) grown by the Czochralski technique.



Atomic Force Microscope image of self-assembled cadmium selenide quantum dots embedded in ZnCdMgSe. The image side is 2x2 μm. The CdSe quantum dots can be used as the optically active region for intersubband IR photodetectors and lasers.



A schematic of cadmium sulfide quantum dot encapsulated in organic poly(propyleneimine) dendrimer host with a DAB (1,4-diaminobutane) core.

DOD CENTER

Continued from page 1

the U.S. government dramatically increased its investment in nanotechnology research and development. A White House statement at the time described nanotechnology as "the new frontier" and said its potential impact for the nation is "compelling."

The DoD Center was established last year at CCNY under a multi-year grant from the U.S. Department of Defense. The College is receiving $800,000 annually for up to five years to fund advances in photonics at the nanoscale.

The DoD Center is headed by Dr. Robert R. Alfano, Distinguished Professor of Science and Engineering at The City College.

Photonics involves the use of small units of light called photons. Photons have unique properties: they travel at ultrafast speed, have color, can be directed easily and emit short pulses on the order of the molecular timescale measured in femtoseconds. The next step in measuring time will be attoseconds. For an idea of how short these time spans are, consider the following: picoseconds (10^{-12}) represent trillionths of a second; femtoseconds (10^{-15}) are a thousand times faster than picoseconds; and attoseconds (10^{-18}) are a thousand times faster than femtoseconds!

Nanotechnology, meanwhile, involves objects that are measured in nanometers (nm) – a billionth of a meter (10^{-9} m), or a millionth of a millimeter – which is smaller than a bacteria cell by 1000 fold.

Over 40 years ago Nobel Laureate Richard Feynman propounded a vision of extreme miniaturization to the molecular scale. Nanotechnology promises to realize his vision and bring about dramatic improvements in electronics, computers and material strength.

A major objective of nanotechnology is to create tiny devices – called nanomachines.

"Our goal," Dr. Alfano said, "is to combine these nanomachines with photonics to make them smarter. Scientists at the DoD Center are seeking to merge and combine photonics and nanotechnology, therefore, in order to develop sources and detectors leading to smart devices that will keep the U. S. at the forefront of these important fields."

For example, "Compact Photonic Explorers" (CPEs) – millimeter-size robotic devices capable of entering the human body – may one-day monitor human health and diagnose or treat abnormalities. CPEs may also be useful for bacterial detection, chemical sensing and industrial and military surveillance. A research team headed by Dr. Alfano has been awarded a patent for the prototype of such a remote-controlled device (U. S. Patent #6,240,312 B1, May 29, 2001), along with funding from the Infotonics Technology Center in Rochester, N.Y., to develop and pursue prototypes. CPEs have the potential to impact diverse industries and disciplines by spinning off new microscale components and technologies. The initial focus is in the biomedical arena, where City College researchers are developing a "photonic pill" that would detect cancer and monitor body functions in living subjects. Future CPEs will be designed to detect biological and chemical hazards, such as bacteria and pollutants, and monitor the "health" of compact structures and devices.

The research is coordinated by Dr. Alfano and supported by a $1.34 million grant from the Infotonics Technology Center. Researchers at CCNY and CUNY are collaborating with teams at Cornell University, Rennselaer Polytechnic Institute, Rochester Institute of Technology, SUNY-Albany, SUNY-Binghamton, The University of Rochester and Boston University to develop and test the technologies for a CPE prototype.

Three major interdisciplinary research projects are currently underway at the DoD Center to make better and smaller devices. They involve (1) nanoscale Cr^{4+}-doped olivine crystallites in glass-ceramics for near-infrared (NIR) optical amplifiers and lasers; (2) semiconductor quantum dot (QD)-based photodetectors and emitter; and (3) hybrid organic-inorganic nanoscale materials for light emission and nonlinear optical device applications.

- The first project, which could lead to small and more efficient wide band amplifiers and lasers, may one-day have a profound impact on optical communications, fiber optic devices, remote sensing, biomedical imaging, and free space optical communication applications.
- The second project will provide tunable ultra-high sensitivity and speed for low-power UV, visible and infrared radiation detection. These small photodetectors and emitters will be highly useful in space communication, lidar, detecting corrosion, cracks and metal fatigue, cancer diagnosis, missile plume detection, optical recording, and monitoring air quality.
- The third project combines two microscopic worlds and may lead to better light emitters with higher oscillator strength, temperature-insensitive lasing threshold, and broad wavelength tunability. This could make possible optical materials with enhanced nonlinearity; magnetic nanosystems with giant internal fields; and nanoscale diagnostic devices for clinical applications. It might also provide the interface and interconnections between tissue and electronic devices.

According to Dr. Alfano, the combined nanotechnology and photonic systems will initially appear as sub-units integrated into larger systems as detectors, light sources, electronic parts, computer elements and materials to make the systems smaller.

The City University plans to construct a state-of-the-art research facility on CCNY's South Campus. It is anticipated that nanoscale and photonics research for sensing applications at the new DoD Center will be a significant area of inquiry in the new facility. ■

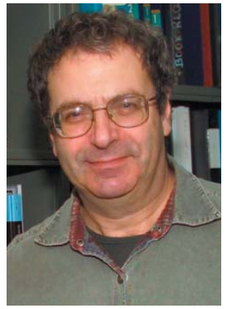
Alexander Efros Joins DoD Center's Advisory Board

Dr. Alexander L. Efros, who has conducted pioneering research on nanocrystals, has been appointed to the Advisory Board of City College's Department of Defense Center for Nanoscale Photonic Emitters and Sensors. Dr. Efros is a Senior Researcher at the Naval Research Laboratory's Center for Computational Material Science in Washington, D.C.

In addition to serving on the Advisory Board he will collaborate with the Center's scientists in research on the physics and spectroscopy of semiconductor Quantum Dots (QD).

"Dr. Efros will offer significant advice to help further research pertaining to Quantum Dots and Quantum Rods," Dr. Alfano said. "He will add a new dimension to the ongoing research at the DoD Center."

The Center was established at City College under a multi-year grant from the U.S. Department of Defense (DoD). CCNY is receiving $800,000 annually for up to five years from the DoD to fund advances in photonics at the nanoscale. Researchers are seeking to merge and combine photonics and nanotechnology in order to keep the U.S. at the forefront of these important technologies.



Dr. Efros is the author or co-author of over 140 articles published in refereed journals, including 8 review papers. His papers published since 1985 have been cited over 3500 times, and he has given 30 invited talks at international conferences and meetings, as well as more than 150 talks at various universities and laboratories.

Dr. Efros is the co-editor, with Professors L. Brus and T. Itoh, of a special issue of *The Journal of Luminescence* entitled "Spectroscopy of Isolated and Assembled Semiconductor Nanocrystals." He is also co-editor, with Drs. D. J. Lockwood and L. Tsybeskov, of a book entitled *Semiconductor Nanocrystals from Basic Principles to Applications*.

He helped organize workshops on "Recent Advances in the Physics of Single Quantum Dots," and on "The Physics of Quantum Dots for Quantum Computing," both held in Washington, D.C. Dr. Efros was co-chair of the 2004 International Conference on Quantum Dots held last May in Banff, Canada. He has also been a member of the advisory and program committees of several international conferences on Quantum Dots.

Dr. Efros received his M.S. in Physical Engineering and his Ph.D. in Physics from the Technical University of St. Petersburg (Leningrad) in 1973 and 1978, respectively. In 2001 he was elected a Fellow of the American Physical Society. ■