



## PHOTONICS TODAY

Spring 2005

### Detecting Hazards for Homeland Security

CAT Photonics research has made a strong showing in the field of biohazard detection for homeland security. A poster presentation on "Fluorescence Detection of Bacteria, Spores and Viruses" was accepted for the conference on "Working Together: Research & Development Partnerships in Homeland Security", held in Boston, Massachusetts, April 27 and 28.

Sponsored by the Science and Technology Directorate of

the U.S. Department of Homeland Security, this conference brought together more than 600 scientists and engineers from government, national laboratories, universities and research institutes and private sector firms, to encourage R&D partnerships and to address the research goals of the U.S. homeland security community.

The CUNY CAT was represented by Dr. Myron Wecker, our Deputy Director

for Administration, and our presentation showcased the results of work by CAT research associates Alvin Katz and Alexandra Alimova, and City College professors Paul Gottlieb and Robert R. Alfano. Homeland security applications are a major focus area for the Photonics Applications CAT.

Our research group at City College is developing native UV excitation and emission spectroscopy as a tool to

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### New CUNY Vice Chancellor Visits CAT

Dr. Selma Botman, CUNY's new Executive Vice Chancellor for Academic Affairs, visited City College to tour CAT facilities on January 8. She was accompanied by Dr. Gillian Small, University Dean for Research.

Following an introduction by CAT Director Robert R. Alfano, there was a presentation by Mr. Alan Doctor, Deputy Director for Business Development. Mr. Doctor discussed "CUNY-CAT Company Sponsorship and Business Development."

Following Mr. Doctor's presentation, Dr. Botman and Dr. Small toured selected photonics research labs and heard reports from scientists on their research, including:

- Professor Vladimir Petricevic on "Cr<sup>4+</sup> Laser Development and Crystal Growth";
- Dr. Alvin Katz on "Optical Biomedical and Biological Sensing Technology";

- Dr. Manuel E. Zevallos, on the "Skin Scanner," which may aid in the early detection of surface and subsurface skin lesions such as skin cancer;
- Dr. Iosif Zeylikovich on "Nanoscale Microscopy".

"I was very proud to host this visit by Dr. Botman and Dr. Small and to have the opportunity to offer them an overview of the CUNY Photonics Initiative," Dr. Alfano said. "Dr. Botman expressed deep interest in the various centers and institutes and demonstrated an impressive understanding of the significance of the Photonics Initiative for CUNY. I look forward to working with her to enhance and expand our efforts in this pioneering field."

Dr. Botman was appointed as Executive Vice Chancellor for

Academic Affairs at CUNY in September 2004. Previously, she has served as Special Assistant to the Chancellor at the University of Massachusetts Lowell, and the Vice President for Academic Affairs at the University of Massachusetts. Her visit to our facilities demonstrates the high priority of photonics research at CUNY and its support from top administrators.



CUNY administrators touring CAT laboratories. From left: Dr. Manuel Zevallos; Dr. Gillian Small; Prof. Robert R. Alfano; Dr. Selma Botman; Prof. Vladimir Petricevic

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## CAT Testing Viral Inactivation for Small Company

Human blood samples and donations can be carriers for pathogenic viruses. Doctors and medical technicians need a safe, reliable means of inactivating viral contaminants in blood samples, without damaging the life-giving cells and plasma.

**Ben-Hur Biophotonics Consultancy**, a small company based in New York City, has

developed a device using ultraviolet light to inactivate viruses in blood samples. This device stems in part from prior joint research between Dr. Ehud Ben-Hur, the company president, and Dr. Paul Gottlieb, Professor of Immunology and Microbiology at the Sophie Davis School of Biomedical Education, CUNY's

Medical School.

Through the CAT, Dr. Gottlieb has begun performing tests of ultraviolet viral inactivation in his laboratory, using the device. This enables Ben-Hur Biophotonics to deliver inactivated blood samples to its clients economically.

## New Laser Crystal Developed at CAT

A new near-infrared laser material, tunable in 1150 – 1480 nm wavelength range, was recently developed in CAT facilities. For the first time, tunable laser operation has been demonstrated for Cr:LilnGeO<sub>4</sub> crystals. Detailed spectroscopic study of this material revealed an unprecedented major feature. Unexpectedly, not only were there Cr<sup>3+</sup> ions alongside Cr<sup>4+</sup> ions, but Cr<sup>3+</sup>, in octahedral sites with mirror-symmetry, proved to be the only laser-

active center.

This is the first demonstration of Cr<sup>3+</sup> laser operation in the range of 1.3 μm, which is important for telecommunications. An ultra-wide range of tunability and high quantum efficiency make these crystals very promising media for optical lasers, amplifiers and ultrashort pulse generation in the near-infrared range of the spectrum.

Development of Cr:LilnGeO<sub>4</sub> nano-nucleated glass-ceramics

will be a very important task for the CAT over the next year, in cooperation with industrial partners. These are expected to be very promising media for NIR tunable lasers and amplifiers. A patent has been applied for to cover this new technology.

This work was conducted by CAT researchers Dr. Alexei Bykov, Dr. Mikhail Sharonov and Prof. Vladimir Petricevic, and was supported in part by Corning Inc.



Prof. David Crouse presents research on photodetectors.

## CAT Professor Forms Spin-Off, Wins SBIR

A new company, **Phoebus Optoelectronics LLC**, was recently spun-off from CAT research and has begun operations. Located in New York City, Phoebus provides intellectual property transfer and optoelectronic design services to the photonics industry, and builds upon the research of **Prof. David Crouse**, an Assistant Professor

of Electrical Engineering at the City College of New York. Prof. Crouse, who is also a member of the CAT's Executive Committee, serves as a full-time consultant for the company and is one of its principals.

Phoebus Optoelectronics recently won an SBIR award from the Air Force, for work on Semiconductor Heterostructure Quantum Wire Multiwavelength

IR Photodetectors for Focal Plane Arrays. This research will be performed by Phoebus with the CAT serving as a subcontractor.

By providing new business counseling and SBIR outreach, the CAT seeks to encourage such entrepreneurial spirit among its faculty.

## Young Researcher Wins Intel Science Contest

David Bauer, a high school senior from the Bronx attending Hunter College High School, won first prize in this year's Intel Science Talent Search. His research was mentored by CAT faculty member Dr. Valeria Balogh-Nair, Professor of Chemistry and Biochemistry at City College of New York (CCNY).

Mr. Bauer's project developed a new system for detecting toxic agents in the nervous

system. Using the properties of fluorescent nanocrystals known as quantum dots (QDs), he created an organic-inorganic hybrid nanodevice to determine if a neurotoxin is present. These devices show great promise for monitoring the exposure of first responders.

Prof. Balogh-Nair's bio-organic chemistry laboratory at CCNY has developed advanced capabilities in combining organic and inorganic materials to

create novel nanoscale photonic devices. This research, financed in part by the Enhanced CAT in Nanoscale Photonics and the DOD Center for Nanoscale Photonic Emitters and Sensors, helped lay the foundation for Mr. Bauer's prize-winning work.

Mr. Bauer plans to attend City College in the fall to study chemistry, and expects to continue working with the bio-organic chemistry lab.

## Detecting Hazards for Homeland Security

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detect several different types of bio-agents, including bacterial cells, spores and viruses. The fluorescence signatures of different bio-molecules found in bacteria and viruses have been observed in several model pathogens, and their spectra characterized.

In addition, Prof. Harry Gafney of Queens College, in collaboration with Professors Nan-Loh Yang and Alexander

Zaitsev of the College of Staten Island, has developed a fiber optic sensor for analytical triage of cargo containers. This method allows for rapid, non-invasive monitoring for explosives, radioactive materials and chemical weapons. CAT business development staff have developed a Technology Opportunity sheet to publicize this approach to interested companies.

The CAT's innovative

techniques for detection of hazards was the centerpiece of a February 3 visit to City College by Dr. Joseph Bauer, of the New York City Department of Health. CAT scientists and staff are committed to fostering collaboration between government, industry and universities in the development of advanced detection techniques for homeland security.

## CUNY Holds Photonics Networking Day

A Photonics Networking Day was held at the Graduate Center of the City University of New York (CUNY), on April 21. This day-long event, sponsored by the Center for Advanced Technology in Photonics Applications (CAT), combined features of the CAT's periodic Scientists Meetings with CUNY's Photonics Initiative Symposium. Open to CUNY faculty, staff and students, as well as representatives of New York State photonics-enabled industries, the event attracted over 60 attendees, and was a great success.

The morning session, the CAT Scientists Meeting, was moderated by CAT Deputy Director for Administration Dr. Myron Wecker. Beginning with a presentation by Mr. Alan Doctor, Deputy Director for Business Development, the morning's centerpiece was a set of presentations by three photonics industry representatives.

The first was Mr. Vincent Benischek, Senior Engineer for Lockheed Martin Maritime Systems and Sensors at Mitchel Field, NY. Mr. Benischek's presentation on Laser Atom Interferometry as a technique for new, more sensitive gravitational sensors, inspired many questions and points of discussion in the audience.

He was followed by Dr. Ronald Pirich, Technical Manager for Northrop Grumman Integrated Systems in Bethpage, NY. Dr. Pirich described the wide range of applications on which photonics is being put to use at the Northrop Grumman Corporation.

The morning session was closed by Mr. David R. Smith, President and CEO of the Infotonics Technology Center in Canandaigua, NY, with a presentation entitled "Bridging the Gap from Research to Market". Mr. Smith described the commercialization efforts sponsored by Infotonics, and the resources they make available to companies and academic researchers.

The body reconvened in the afternoon for the Photonics Initiative Symposium. Greetings from University Dean for Research Gillian Small, confirming CUNY's continued commitment to photonics research, were followed by a presentation by Prof. Robert R. Alfano detailing the status of the initiative, the progress made to date by newly hired faculty, and plans for the future. Prof. Harry Gafney of Queens College moderated the event, and introduced the three main presenters, from the recently appointed faculty.

Prof. David Crouse of the Electrical Engineering Department at City College presented results from his research on "Electromagnetic Resonance Enhanced Photodetectors". His program in Applied Plasmonics seeks to enhance the field of photodetection through thorough modeling and device design at the cutting edge.

Prof. Vinod Menon of the Physics Department at Queens College presented on "Photonic Building Blocks for Quantum Informatics". He also described the Laboratory for Nano and Micro Photonics which is now being set up at Queens College.

Lastly, Prof. Ralf M. Peetz of the Chemistry Department at the College of Staten Island, presented on "Conjugated Oligomers: Structure/Properties and Application in an Electronic Nose".

Altogether, the presentations confirmed that the CUNY Photonics Initiative has brought in innovative new faculty at the leading edge of the field.



Prof. Ralf M. Peetz (left), College of Staten Island, and David R. Smith, Infotonics, converse during CUNY Photonics Networking Day. In background, Prof. Nan-Loh Yang, College of Staten Island.

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DO YOU HAVE A PROBLEM REQUIRING  
APPLICATION OF PHOTONICS TECHNOLOGY?  
LET THE CUNY-CAT HELP YOU  
INVESTIGATE AND SOLVE IT!  
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### About the CUNY CAT...

"Photonics for real-world applications" is the central theme of the Center for Advanced Technology in Photonics Applications at the City University of New York (CUNY CAT). The CAT, designated in 1993 and re-designated in 2004, is one of 15 New York State Centers for Advanced Technology. The mission of the center is to develop and disseminate knowledge in photonics technology in order to promote New York economic development for the medical, biological, industrial and military sectors.

The CAT assists New York State companies to reduce expenses, increase productivity and efficiency, improve staff capabilities, and create and retain jobs. To accomplish this, the CAT conducts high-level research; establishes technology transfer mechanisms; provides the photonics industry with access to CUNY technology, research equipment, testing facilities and faculty expertise; trains workers for the photonics industry; works with other organizations to promote New York as an attractive home to photonics-based companies and their employees; and, assists companies to obtain grants and start-up funds.