CAT
New York State Center for Advanced Technology in Ultrafast Photonics at the City University of New York

PHOTONICS TODAY

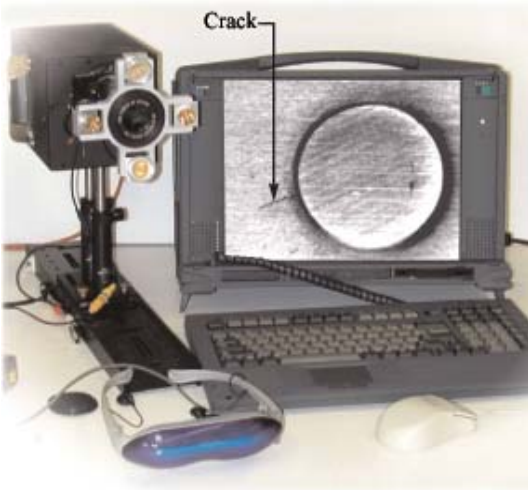
Fall 2003

Lockheed Martin Marketing New Photonic Product Based on CAT Research

CUNY CAT partner Lockheed Martin has introduced a new product for detecting cracks and corrosion under paint, entitled the "Rapid Acquisition Surface Inspection System (RASIS)". Based on collaborative efforts with the CAT for basic research, and CUNY's Technology Transfer Incentive Program for applied research and prototype development, the RASIS system is a real-time, hand-held or robotic-mount imaging system that can image through paint to non-destructively inspect aircraft micro-cracking around rivet heads and detect the earliest stages of surface corrosion beneath surface layers of paint.

RASIS detects aircraft micro-cracks with greater resolution than competing existing technologies. Its speed, ease of use and real-time imaging capabilities were made possible by the CAT's advances in infrared imaging. With the ability to rapidly inspect structures and surfaces, the system permits early detection and eliminates the need for paint removal for inspection. These features promise to be very attractive to potential users.

Promotional materials have been developed and are in distribution to establish interest from potential clients, which include plane manufacturers and servicers, and NASA. In addition to significant cost savings realized by Lockheed Martin due to its collaboration with the CAT, product sales from $500,000 to $1.5M are anticipated over the next three years.



RASIS system, developed by Lockheed Martin and the CAT.

New CAT Research Focus: Chem-Bio-Hazard Detection for Homeland Security

The CUNY CAT has announced a program of matching funds for joint industry-university research programs in the detection of chemical and biological hazards. This research initiative will focus on developing means of detection to enhance security against terrorism and other events which pose the risk of exposure to dangerous agents. The recent threat of bio-terrorism has heightened the need for sensors to detect bacterial cells and spores. Effective sensors would provide continual remote monitoring and be able to rapidly warn of the presence of a threat. Ideally, sensors would not use reagents or introduce potentially harmful chemicals into the environment. Technologies based on optical spectroscopy satisfy these requirements. The CUNY CAT is currently developing photonic techniques to detect bacterial cells and spores in real-time. These methods are based on the CAT's ongoing biomedical optical research programs.

Several native fluorescing molecules are found naturally in living cells and tissues. When illuminated with light of the proper wavelength, these molecules re-emit light at different, distinct wavelengths. The detection of a molecule's fluorescence spectra is evidence of the presence of that molecule. In addition to these methods for detecting bacterial cells, CAT scientists have begun to research the

(Continued on page 2)

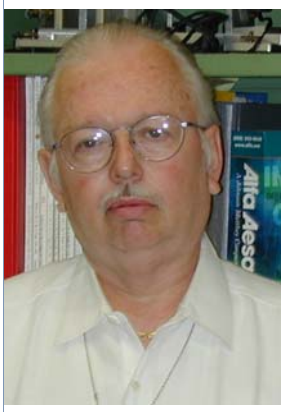
Inside this issue:

For more information on the CUNY CAT, contact:

Alan Doctor
CUNY Center for Advanced Technology
Department of Physics, Room J-419
138th Street & Convent Avenue
New York, NY 10031
Phone: 212-650-8265; Fax: 212-650-8481
doctor@ee.ccny.cuny.edu
www.cunyphotonics.com

NYSTAR designated Center for Advanced Technology (CAT)
New York State Office of Science, Technology & Academic Research

Any opinions, findings, conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect the views of the New York State Office of Science, Technology and Academic Research



Alan Doctor

New Business Development Manager: Alan Doctor

We are pleased to welcome Alan Doctor as our new Business Development Manager. Mr. Doctor brings a wide variety of experience in the development and marketing of military and industrial applications of photonics technology. His primary function is to generate interest and cooperation between the CAT and New York State companies to collaborate on research and product development projects. Mr. Doctor holds a BEES in Materials Science from SUNY Stony Brook and has published and presented numerous technical articles. He also holds several photonics technology based patents.

Alan explained recently, "I am amazed by the caliber of the CAT faculty I have met and the breath of the ongoing research here." Mr. Doctor added, "Our mission is to facilitate interaction between New York's industrial base and the CUNY campuses, to advance and improve photonics technology, research real world applications and assist R&D at companies in New York State. I am excited about the possibilities!"

CAT on the Prowl: CAT Office Moves

The CAT administrative offices of have moved to the Steinman Engineering Building at City College. After the destruction of our original facilities in the attack on the World Trade Center, we had found a temporary home in offices at Baruch College. With the relocation to City College, the CUNY CAT's administrative staff has found a permanent home, close to the offices of CAT Director Robert R. Alfano, several CAT researchers and the facilities of the Institute for Ultrafast Spectroscopy and Lasers. We anticipate that the move will help further the CAT's mission of close collaboration between scientific research and business development. For new CAT contact info see the back of this newsletter or visit us online at www.cunyphotonics.com

Compact Photonic Explorers Project Moves Ahead

On March 12, 2003, the CUNY CAT hosted the kick-off meeting of the Compact Photonic Explorers (CPE) project, a $1.7M endeavor funded by the Infotonics Technology Center and the CAT. The project, which includes investigators from City College, SUNY-Albany, SUNY-Binghamton, Rennselaer Polytechnic Institute, Rochester Institute of Technology and Boston University, is directed by CAT Director Robert R. Alfano.

CPE Kick-Off Meeting. From Left - Standing: M. Dafflon (RPI), R. Raffaelle (RIT), J. Castracane (SUNY-Albany), R. Alfano (CCNY), H. Stephanou (RPI), J. Cho (SUNY-Binghamton), M. DiPietro (SUNY-Binghamton), T. Moustakas (BU). Seated: Y. Bellouard (RPI), S. Zhang (CCNY).

The goal of the project is to produce miniature remote health monitoring devices, beginning with a "photonic pill," containing on-board sensors and computers to be ingested into the human body to analyze various biological conditions. Other versions are envisioned for remote monitoring of water quality and structural integrity.

This project will stimulate new developments in such areas as subminiature power sources, light sources and detectors, and nanoscale manufacturing and assembly techniques.

To date we have developed and assembled a medium-size CPE as a precursor to the photonic pill, as well as a prototype hand-held device for use in skin cancer detection and corrosion detection. These results were demonstrated at a recent site visit.

Chem-Bio-Hazard Detection

(Continued from page 1)

emissions properties of spores, such as those of *Bacillus Anthracis*, which causes anthrax. An important constituent of spores absent in active cells is dipicolinic acid (DPA). CAT researchers are developing methods to detect the presence of spores based on fluorescence from DPA.

In addition, recent studies conducted at CUNY have demonstrated that light scattering measurements may be able to detect and identify microbial contamination. In these experiments, a series of optical transmission and light scattering measurements were performed on three species of bacteria with different sizes and shapes. This could be a new method for screening areas for biohazard contamination with a high degree of accuracy.

Lastly, CUNY researchers have begun developing a system using optical fiber transmission to detect chemical and biological contaminants in cargo containers. The fiber is prepared with special coatings which, if exposed to a contaminant, cause changes to the spectral signature of the light being transmitted. Research to develop the necessary fibers and protocols to make this system commercially viable have begun.

CUNY Photonics News

New CAT Researcher Partners with Pfizer

Pfizer Inc. has partnered with new CAT researcher **Dr. Gillian Small**, CUNY's Associate University Dean for Research and an Associate Professor in the Biology Department at City College. The joint research project, Characterization of Novel Proteins Involved in Sterol Homeostasis, is part of a long-term research goal of gaining a complete understanding of the mechanisms involved in regulating lipid metabolism.

Cholesterol and lipoprotein compounds such as HDL and LDL are important contributing factors to various cardiovascular diseases. 62 million Americans suffer from Cardiovascular diseases, which kill nearly a million every year, more than any other cause of death. Nationwide, costs related to these diseases exceed $300 million a year. Pfizer seeks a full understanding of the cellular mechanisms regulating the levels and composition of these compounds, for developing the next generation of treatments for the prevention, management and cure of cardiovascular diseases.

Dr. Small is using photonic techniques, such as fluorescence microscopy, to probe the genetic and molecular processes of the cell itself. Her current focus is on sterols, a family of molecules which includes cholesterol and can be found in all organisms.

Dr. Gillian Small

Research at City College Earns STS Semifinal Award

Based on his original research conducted at the CAT facilities, Stuyvesant High School student **Aleksander Chechkin** was designated a semifinalist in the 62nd Annual Science Talent Search (STS). His paper, Internal Rotational Spectrum of the Tryptophan Molecule Using Laser Terahertz Pulse Spectroscopy, reports the first known observation of seven rotational-rocking levels for the molecule. Mr. Chechkin also exhibited his results at the New York City Science and Engineering Fair, where it was awarded "best project" in physics. He thanks CAT Director Robert R. Alfano and CAT researchers Baolong Yu and Massood Siddique for their assistance. As an STS semifinalist, Mr. Chechkin earned matching awards of $1,000 for himself and his high school. He plans to attend the California Institute of Technology. We congratulate him and wish him excellent luck in his continuing studies and research.

CUNY Photonics People

Peter J. Delfyett, Ph.D. is University Distinguished Professor of Optics, Electrical Engineering and Physics at the University of Central Florida (UCF), and leads the Ultrafast Photonics group at UCF's School of Optics. In 1993, he was named Most Promising Engineer by the Black Engineer of the Year Awards, and in 2000 was recognized for Outstanding Alumnus Achievement, showing that he had lived up to that promise. He was also a 1996 recipient of the Presidential Early Career Award for Scientists and Engineers from the NSF. Prof. Delfyett serves as Editor-in-Chief of the IEEE Journal of Selected Topics in Quantum Electronics, and his research interests include high-speed optoelectronics, photonic networks, optical information processing, ultrafast phenomena and optical physics and spectroscopy.

After completing his bachelors degree in Electrical Engineering at City College, he went on to obtain his M.S. at the University of Rochester and study Physics at the Ph.D. level at City University of New York, earning his degree in 1988. His Ph.D. thesis was supervised by Cat Director Prof. Robert R. Alfano, and was focused on developing a real time ultrafast spectroscopic probe to study molecular and photon dynamics in condensed matter using optical phase conjugation techniques. Since then, Prof. Delfyett has had a successful career, beginning at Bell Communication Research and joining the faculty at UCF in 1993. He has published over 200 papers and been awarded twelve U.S. patents, and recently received widespread publicity when his group successfully crossed the terabit threshold for optical communication.

Prof. Delfyett describes his experience as a CUNY graduate student as "a truly wonderful and exciting time in my life." He explains, "I was exposed to state-of-the-art facilities and was provided the opportunity to be the best that I could be. Prof. Alfano provided me with the guidance and encouragement to continue to dig deep and focus on the problem at hand. I was able to grow and thrive under his supervision and owe much of my success to him." Prof. Delfyett points out that he carries the same high expectations and approach to scientific inquiry he learned from Prof. Alfano into the training of his own students.

Peter J. Delfyett, Ph.D.

"Prof. Alfano provided me with the guidance and encouragement to continue to dig deep and focus on the problem at hand."

Peter J. Delfyett

New York State Center for Advanced Technology in Ultrafast Photonics at the City University of New York

New York State Center for Advanced
Technology in Ultrafast Photonics
at The City University of New York

Department of Physics, Room J-419
138th Street & Convent Avenue
New York, NY 10031

PHOTONICS TODAY

Fall 2003

For more information on the CUNY CAT, contact:

Alan Doctor
CUNY Center for Advanced Technology
Department of Physics, Room J-419
138th Street & Convent Avenue
New York, NY 10031
Phone: 212-650-8265; Fax: 212-650-8481
doctor@ee.ccny.cuny.edu
www.cunyphotonics.com

About the CUNY CAT…

"Ultrafast photonics for real-world applications" is the central theme of the Center for Advanced Technology in Ultrafast Photonics at the City University of New York (CUNY CAT). The CAT, designated in 1993, is one of 15 New York State Centers for Advanced Technology. The mission of the center is to promote economic development in the state by generating and disseminating knowledge in photonics technology, encouraging industrial competitiveness, and producing future leaders in photonics technology through educational and research programs.

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.