FIP Seventh Annual Meeting
October 11-12, 2007 - Schiciano Auditorium
Symposium on Photonics in the Translational Era: Science and Technology for a Purpose

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Duke Broadband
Fitzpatrick Institute for Photonics
305 Teer Building, Box 92277
Durham, NC 27708-0277

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Student Spotlight
Ellerbee receives 2007 Golden Torch Award

“Going nano”

Jokerst Leads Development of New Cleanroom Facility

The new Duke Shared Materials Instrumentation Facility (SMIF) is a key enabling resource that will help realize a vision for nano-opto-bio-info integration that joins SMIF to the Fitzpatrick Institute for Photonics (FIP). Story continued on page 4
It is my great pleasure to introduce the first issue of **BROADBAND**, the newsletter of the Fitzpatrick Institute of Photonics (FIP). FIP is now officially a Duke Institute and world class leader in important and emerging areas of photonics, the science and technology related to the interaction between light and matter. The Institute integrates the broad ranging, cross-disciplinary faculty strengths in photonics research.

As we are at the early years of a new century, I believe that photonics is a research area uniquely suited to address the challenges and fulfill the promises of a new era. We are focused on cultivating the next technology revolution at the nexus of the nano-info-opto convergence.

Please join us at **The 7th Annual Meeting of the FIP on October 11-12, 2007 at Duke University, Durham, North Carolina**. We are hosting a Symposium titled “Photonics at the Translational Era: Science and Technology for a Purpose.” Please visit our website at fittpatrick.duke.edu to learn more.

My best wishes for an enjoyable and successful 2007 Fall Semester.

**Tuan Vo-Dinh**
FIP DIRECTOR AND PROFESSOR

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**2006-2007 HIGHLIGHTS**

- Increased faculty membership in FIP from 25 in 2006 to 60 faculty members belonging to 16 departments and institutions from the Pratt School of Engineering, the School of Arts & Science, and the School of Medicine at Duke.
- Promoted cross-disciplinary translational research by establishing new collaborative projects with other institutions (e.g., Duke Comprehensive Cancer Center).
- Established a Task Force on Education to expand the FIP Graduate Certificate in Photonics (GCP) program and develop an integrated photonics education program in collaboration with various departments.
- Organized the Sixth Annual Meeting on September 28-29, 2006, with keynote lecture delivered by Dr. Charles Townes, Nobel Laureate in Physics and inventor of the laser.
- Established a Corporate Partnership Program to strengthen interactions between FIP faculty and industrial developers. Several major photonics companies, including Nortel, Hamamatsu, Newport-Spectra Physics, and New Focus have joined as FIP corporate partners.
- Promoted regional economic development, photonics education and growth of the photonics industry in the Carolina region.
- The Photonics Certificate program is offered to the Graduate students by the Institute, both undergraduate and graduate levels are cross-listed among multiple departments. About half of these courses have strong laboratory components and are offered at the Institute’s state-of-the-art Photonics Teaching Laboratory, providing our students with opportunity for hands-on learning experience. Key foundation courses at both undergraduate and graduate levels are cross-listed among multiple departments. The Photonics Certificate program is offered to the Graduate students by the Institute, and has seen expansion in enrollment over the last few years.

Audrey Ellerbee receives 2007 Golden Torch Award

Audrey Ellerbee, a Ph.D. student in the laboratory of biomedical engineering professor Joseph Izatt, was selected Graduate Student of the Year by the National Society of Black Engineers. She received her 2007 Golden Torch Award at the NSBE’s national meeting in Columbus, Ohio, in March. This significant honor recognizes Ellerbee’s academic and extracurricular contributions. Ellerbee’s research is focused on optical coherence tomography (OCT), and her work is supported by an NSF graduate research fellowship, the Duke Endowment, a James B. Duke fellowship and the University Scholars program. She earned her B.S.E. in electrical engineering from Princeton in 2001 and taught for a year in Singapore before coming to Duke.

Following graduation in August, Ellerbee will begin the year as winner of the prestigious 2007-2008 Optical Society of America International Society for Optical Engineering Congressional Fellowship in Washington, D.C. Typically, fellows conduct legislative or oversight work, assist in congressional hearings and debates, prepare briefs and write speeches as a part of their daily responsibilities. By applying her scientific expertise in this policy environment, Ellerbee will help in broad awareness of the value of scientist-engineer-government interaction.

Education Task Force

The FIP Educational Task Force (co-chaired by Professors Dan Gauthier, Joe Izatt and Jungsang Kim) has been strengthening Photonics education at Duke University across departmental boundaries. The Photonics-related courses offered at graduate and undergraduate level has expanded dramatically since the inception of the Institute, with more than 16 courses on the topic of Photonics offered by five different departments on a regular basis today. About half of these courses have strong laboratory components offered at the Institute’s state-of-the-art Photonics Teaching Laboratory, providing our students with opportunity for hands-on learning experience. Key foundation courses at both undergraduate and graduate levels are cross-listed among multiple departments. The Photonics Certificate program is offered to the Graduate students by the Institute, and has seen expansion in enrollment over the last few years.

Jungsang Kim, Ph.D.
Nortel Networks Assistant Professor
Electrical and Computer Engineering Dept.
Jokerst Leads Development of New Cleanroom Facility

The new cleanroom nanofabrication facility includes instrumentation like electron beam lithography system with viability to write 10 nm feature sizes, and a bio-bay that enables the integration of biological media with more traditional semiconductor materials.

SMIF characterization facilities include a new Cryo-TEM geared toward both biomedical and materials imaging. While Duke plans to hold an official dedication of the facility in the spring of 2008, faculty, graduate students and industry researchers are moving in now and undergoing training.

Director Mark Walters and Executive Director and Professor Nan Jokerst teamed with existing faculty users of a smaller facility to create a unique user resource both for Duke and the Triangle community.

SMIF will enable research aims such as Jokerst’s research into integrated chip scale photonics, an area of emphasis at the FIP. Chip scale integrated optical systems are emerging as an enabling technology for portable sensor systems. These systems need to integrate an optical source, optical interconnections, and sensing or signal processing elements, optical sensors, readout of the optical sensor, and, in many cases, signal processing circuitry and a wireless communication link. Thus, a fundamental goal for chip scale photonics is the integration of active optoelectronic devices and passive waveguide structures at the board and chip levels within the constraints of the manufacturing environment for low cost electronics.

Heterogeneous integration, one method of integrating photonic active devices into systems, enables the system designer to integrate independently optimized optoelectronic and passive components onto arbitrary substrates, including epoxy printed wiring board, glass, polymers, Si, and Si CMOS ICs. The heterogeneous integration technologies employed by Jokerst’s research group utilize compound semiconductor devices that are separated from the growth substrate through selective etching. These thin film devices (nanometers to microns thick) are then integrated onto substrates such as a Si CMOS integrated circuit, or can be embedded in a polymer planar photonic structure. The integration of a vertical optical source (a resonant cavity enhanced light emitting diode) onto a Si CMOS IC with analog control and digital signal processing circuitry as well as Si CMOS photodetectors enables the direct control of this bi-directional optical system using on-chip circuitry.

This highly collaborative work engages the disciplines of photonics and integration (Jokerst), analog circuits (Martin Brooke, Duke University), and digital circuits (D. S. Wills, Georgia Tech). The addition of a sensor between a point to point interconnection, such as a microring sensor will complete a chip scale integrated planar photonic sensing system. In addition, first steps toward the integration of a photonic system with a microfluidics system has been demonstrated at Duke, for a low cost, portable malaria diagnostic tool using photonics (Jokerst), digital microfluidics (Richard Fair, Duke University), and microbiology and medicine (Debra Schwinn, University of Washington).

The new clean room facilities of the Duke Shared Materials Instrumentation Facility (SMIF) will be an outstanding resource addition for all FIP faculty at Duke University.-TUAN VO-DINH
ENTREPRENEURSHIP

PLATINUM PARTNER

SILVER PARTNER

PARTNER

PHOTONICS FACILITIES IN THE CAROLINAS

CPC - Carolina Photonics Consortium

Duke University has teamed with North Carolina State University, the University of North Carolina at Charlotte, Western Carolina University, and Clemson University to form the Carolina Photonics Consortium (CPC). Representatives of each university signed a CPC Inter-Institutional Agreement to establish a foundation for collaborative university technology transfer programs. In the coming years in order to encourage need-driven research and further develop technology transfer programs. In this activity the FIP works closely with the Office of Corporate Industrial Relations at the Pratt School of Engineering at Duke.

This is a tremendous opportunity to bring science and technology into the service of society—to translate research from the idea stage to the bench top and ultimately into use on the ‘street’. - TUAN VO-DINH

“Through partnerships between members of the Duke Comprehensive Cancer Center and faculty from the Fitzpatrick Institute for Photonics, investigators have created unique synergies in which knowledge and expertise shared, and complimentary strengths are engaged to expand the opportunities for exciting discoveries in science and medicine.”

- H. KIM LYERLY, MD

Directer, Duke Comprehensive Cancer Center

P R O J E C T S & S O U R C E S

- “Photonics technology has the potential to change everything from communications to process control to patient care and Duke’s Fitzpatrick Institute is positioned to provide the kind of market facing innovations that will drive that change.”

- BARRY S. MYERS, MD, PH.D, MBA

Senior Associate Dean for Industrial Partnerships and Research Commercialization, and Professor

PARTNERSHIP PROGRAM

A main goal of the FIP Corporate Partnership Program is to strengthen its industrial relations programs in the coming years in order to encourage need-driven research and further develop technology transfer programs. In this activity the FIP works closely with the Office of Corporate Industrial Relations at the Pratt School of Engineering at Duke.

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