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University of Dayton. Electro-Optics and Photonics Program

Electro-Optics News

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Electro Optics Program Moves to a New Building

After nearly 20 years in Kettering Labs, EO has now moved to a newly renovated space in College Park Center (CPC) building. This move consolidates the EO administrative and faculty offices and labs with LOCI, the Air Force sponsored Center of Excellence. Although parts of EO are still on the main campus, such as Dr. Power's and Dr. Sarangan's labs, most other operations have been relocated to CPC.

This move opens up extra space for existing labs and leaves room for future expansions. It creates a distinctive home for EO away from the hustle and bustle of the main campus. It is also a lot closer to the restaurants on Brown Street and the student parking lot. One obvious disadvantage is the distance to the UD's central administration. But with the upcoming UDRI's move to 1700 South Patterson Building (former NCR world headquarters), EO will be strategically located between the main campus and UDRI, and our faculty and students will have easy access to both areas of campus.

Visitors to EO now need a card access or a visitors pass to enter the facility. There is an attendant on duty during business hours. With expanding research labs and expensive equipment, this brings about the much needed security for our labs and provides a seamless 24/7 access to students and faculty.

If you are in the area, please come by and see our new offices.

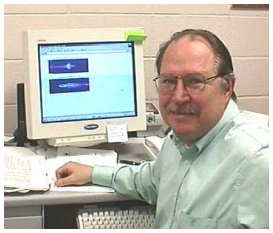
Professor Mikhail Vorontsov

In September 2009 Dr. Mikhail Vorontsov joined UD as the founding recipient of the WBI LOCI endowed Chair. His graduate education was completed at Moscow State University. From 1977 until 1993 he was a professor of physics with joint appointments in the Physics Department and in the International Laser Center of Moscow State University. Prior to joining UD he was a senior physicist in the Computational and Information Sciences Directorate of the Army Research Laboratory, in Adelphi MD. He was concurrently a Research Professor at the University of Maryland, College Park and held adjunct appointments at the New York University School of Medicine; and at New Mexico State University.

He is a world renowned scientist with research activities in many areas including atmospheric propagation effects; imaging through turbulence, wave-

(Continued on page 4)

Director's Corner



Joesph W Haus
Director

The new academic year is upon us and we are ready to greet a new class of students. The Electro-Optics Program has moved to a new building; it is an outward sign of the transformation it has undergone in the past decade. We have grown to six faculty lines with strong collaboration from Physics and a renewed connection to Electrical and Computer Engineering. We are honored that Peter Powers was appointed to the Mann Chair in the College of Arts and Sciences. This is a career growth opportunity for Peter to broaden his range of research centric activities to outreach in the community. We are happy to support Peter in making a great leap forward.

The LADAR and Optical Communications Institute (LOCI) established as an Air Force Center of Excellence in 2006; it has 10,000 sf of new space and three new permanent staff. Dr. Paul McManamon, formerly the Chief Scientist for the Sensors Directorate at AFRL, is the Technology Director who is strategically guiding LOCI to future research directions. It has reached a growth phase with research activity and will have 17 students this year and research activities have grown to support six staff positions. Our six Industry Partners and the University of Dayton have generously supported our goals and helped guide LOCI through its establishment phase.

Prof. Mikhail Vorontsov joined UD last Fall as the Wright Brothers Institute LOCI endowed Chair. He built a 5000 sf space called the Intelligent Optics Lab and has created research collaborations with Army Research laboratory and the VA Medical Center. More details on that topic can be found in the article in this issue. The EOP has cultivated many new friends in China with the steadfast commitment of Dr. Qiwen Zhan. We established a meeting that is called the International Conference on Nano-photonics four years ago in Hangzhou, China. This year it was held in Tsukuba, Japan. See our story about that event. Our engagement in China continues with three new students joining our already very strong contingent of Chinese students, post docs and visitors.

We invited our alumni and friends who have not stopped by for a visit in recent years to come by and see what I mean by the transformation of the EOP. Wait and see what the future has in store for us as we plan future growth!

Check out our new website:
http://www.udelectro-optics.org

EO Field Trip

EO students had assembled a payload consisting of an automated camera, impact sensors, optical thin film materials and flash memory drives.

In 2009, a group of EO students organized a field trip to Space Port Indiana at the Columbus Municipal Airport in Indiana. Space Ports are part of a nationwide effort to make near-earth orbital platforms accessible to commercial ventures. The platforms are mostly helium inflated balloons or small rockets.

EO students had assembled a payload consisting of an automated camera, impact sensors, optical thin film materials and flash memory drives. Raytheon brought a 3D situational awareness and visualization system for flight testing.

After breakfast and a pre-launch meeting, the balloon was inflated in a hanger next to the runway and was released. Live telemetry data showed a maximum altitude of 90,000 ft. After landing, the payload was retrieved by the recovery crew near Lexington, KY. The recovered items contained a wealth of useful information, but unfortunately our camera experienced a battery problem and stopped running soon after lift-off. Despite the setback, on future launches we are planning on using high altitude laser experiments and imaging projects.

Student Spotlight — Wen Cheng

Wen completed her undergraduate study at Nanjing University of Posts and Telecommunications (China) in 2007 majoring in Optical Engineering. This is the same University as one of our previous students Meng Shu.

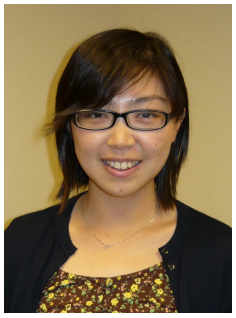
Having been in the same city from elementary school to college and having lived near her family all that time, she wanted to assert some independence and make a change to her life. Aspired by her pursuit for higher knowledge, she made one of her most challenging decisions: going to the US for a PhD degree.

"I know people say engineering is not very trendy for girls." Wen says, "I see it differently. The process of learning is fascinating and the completion of a challenging project is even more unforgettable. The combination of my professional knowledge with being a female student always makes me feel unique."

"Life was not easy when I first arrived in the US. I had to work part time in the cafeteria to make a living". Things got better after 2008. She got a DAGSI scholarship, and then was hired as a TA in the physics dept. "Dayton is a good place for study because there are fewer distractions" she says.

Her MS research was on the vortex propagation through turbulence atmosphere under the supervision of Dr. Qiwen Zhan. She presented a paper at Photonics West and also wrote a journal paper. Now, for her PhD, she is working on a beam shaping project to achieve 2D flattop beam profiles by adjusting the polarization weights of beam components. Laser beams with flattop profiles have applications in laser material processing and lithography.

Wen loves Chinese cooking, shopping and travelling. She has been to many places in China and United States, Canada and Japan. "The adventure and unexpected amazing moments always make me feel how wonderful life is. It is worth every effort and gives me the faith I can make my life better and better."



Wen Cheng
PhD student

International Conference on Nanophotonics

The International Conference on Nanophotonics in Tsukuba, Japan hosted more than 320 attendees from 31 countries at the end of May this year. Profs. Kiyoshi Asakawa and Kazuaki Sakoda hosted the event, which was endorsed by The Optical Society of America and Optical Society of Japan and supported by a number of Japanese agencies and companies. In the previous three years it was held in China (Hangzhou in 2007, Nanjing in 2008, Harbin in 2009) and next year it will return to Shanghai, China. Nanophotonics is a rapidly growing and emerging multidisciplinary field that deals with optics and photonics on the nanoscale. The objective of this topical conference is to bring together international scientists and researchers interested in recent developments in nanophotonics. Drs. Qiwen Zhan and Joseph Haus have been deeply engaged in establishing this Nanophotonics themed conference in China.

The conference mission is to foster mutual communications with face-to-face discussions among scientists and engineers from around the world. Interaction among physicists, chemists, and biologists is vital for multidisciplinary advancement in semiconductors, metals and organic materials and for nanofabrication, nanocharacterization, design and modeling.

The list of speakers represented a stellar group of researchers in the various sub fields. Motoichi Ohtsu (Tokyo) and Paras Prasad (SUNY Buffalo) were keynote speakers. The plenary speakers were Stephen Chou (Princeton), Federico Capasso (Harvard), Thomas F. Krauss (St. Andrews, UK), Concita Sibilia (Roma, Italy), and John T. Fourkas (Maryland) as plenary speakers. There were 32 invited speakers 60 oral contributed papers and 180 poster presentations. Two tutorial courses given by Joseph W. Haus, Qiwen Zhan and Jiangeng Xue were free to attendees.

Typical paradigms of nanophotonics involve electromagnetic waves coupled to metals, so-called surface plasmons, that can create extremely small integrated circuits or sensors. The conference highlighted multidisciplinary fields such as biology, energy and environmental fields..Topics covered include applications of quantum dots and chromophores that can find applications in next generation solar cells, photocatalytic reactors, medical therapies, UV lighting materials, nano-bio-sensing and imaging.

Tsukuba, Japan

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Professor Mikhail Vorontsov….

front sensing and control (adaptive optics) , and nonlinear spatio-temporal dynamics. Applications of his research include: Optical communications, directed energy, imaging, laser tracking, target designation and laser radar. His technical achievements in adaptive optics include development of the theoretical foundation for adaptive two-dimensional feedback systems, and the first demonstration of wavefront phase distortion compensation using an all-optical adaptive technique. More recently, he pioneered the development of the model-free parallel stochastic gradient descent (SPGD) adaptive optics systems; high-resolution and high-speed wavefront sensors; and lucky region fusion technique for image quality improvement under anisoplanatic conditions. Prof. Vorontsov built a 5,000 sf laboratory space called the Intelligent Optics Lab that includes five rooms and a 30m indoor range hall. He has an agreement with the VA Medical Center to build a structure on their roof to house instruments for his turbulence experiments over 7km distance between his lab and the VA Medical Center. He created research collaborations with Army Research Laboratory and has conducted deep turbulence experiments in Hawaii over a 149 km optical path. To manage his many diverse research activities he has hired two Ph.D. staff members.

Dr. Vorontsov is a frequently requested invited speaker and guest lecturer and has chaired a number of international conferences. He has published over 250 papers and four books. His papers have been cited more than 1000 times. He recently completed a book on Wavefront Control in Optics and is teaching a new course this Fall on the topic of wavefront control in optics. Dr. Vorontsov is a recipient of several awards including: University of Maryland "Outstanding Systems Engineering Faculty" award (2008); U.S. Army Research and Development Achievement Award: "Target-in-the-Loop Beam Control and Active Imaging"; ARL Achievement Award for Best Publication (2006) and ARL Achievement Award for Science for development of a new generation of adaptive laser communication and imaging systems (2000). He is an ARL fellow and fellow of the Optical Society of America (OSA) and the Intl Society for Optical Engineering (SPIE).

Recent Graduates

Ph.D

Lirong Sun, Dec 2009
Profile Control and Etching Mechanisms in an Inductively Coupled Plasma for Silicon, Silicon Dioxide and Lithium Niobate

Weibin Chen, Dec 2009
Focus Engineering with Spatially Variant Polarization for Nanometer Scale Applications

Michael Greiner, Dec 2009
Effects Of Multiple Photon Scattering In Deciduous Tree Canopies

Alain Tschimwang, May 2010
Building and Testing a High Spatial Resolution Nulling Micro-ellipsometer Using Rotational Polarization

Patrick Berry, May 2010
Versatile Chromium-Doped Zinc Selenide Mid-Infrared Laser Sources for Scientific and Military Applications

M.S.

Katherine Drain, Aug 2009
Novel Optical Components for Non-Mechanical Beam Steering

Wen Cheng, Dec 2009
Propagation of Vortex Beam Through A Turbulent Atmosphere
Jason Stafford, Dec 2009
Peturbation Analysis and Experimental Demonstration of Holographic Aperture Ladar Systems
Andrew Stokes, Dec 2009
Improving Mid-Frequency Contrast In Sparse Aperture Optical Imaging Systems Based Upon the Golay-N Family of Arrays
Wei Han, Dec 2009
Transmissive Beam Steering Through Electrowetting Microprism Arrays
Jared Cordray, May 2010
Investigation of Liquid Crystal Spatial Light Modulators to Simulate Seckle Fields
Eric Bailey, May 2010
Sparse Frequency, Linearly Frequency Modulated Laser Radar Signal Modeling and Doppler Processing
Benjamin Booso, May 2010
The Growth of Columnar Thin Films and their Characterization Within the Visible and Near Infrared Spectral Bands
Renjie Zhou, May 2010
High Power Fiber Laser Development and Applications
Jean Bosco Serushema, Aug 2010
Wave Propagation Through Multilayer Metallo Dilectric: Application to Super Resolution
Jonathan Evans, Aug 2010
Rapid Beamswitching of an ND:YAG Laser using domain Engineered Prisms in 5 MOL% Magnesium-Oxide Doped Congruent Lithium Niobate

Optics Quiz

A metal used for eyeglass frames that will bend, but not break, is called:
- Flex steel
- Shape memory alloy
- Metallo-dielectric

Who is generally credited with the invention of the laser?
- Luke Skywalker
- Gordon Gould
- Albert Einstein

An optical telephone system called the photophone was first patented by
- Alexander Graham Bell
- Thomas Edison
- Humphrey Bogart

One of the goals of the Hubble Space Telescope was to confirm the Hubble Theory. What does that theory say?
- The universe is expanding
- The universe is collapsing
- Gravity can deflect light
- There is life on other planets