

Fall 2012

## EON, Vol. 01, No. 01

University of Dayton. Electro-Optics and Photonics Program

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### Recommended Citation

University of Dayton. Electro-Optics and Photonics Program, "EON, Vol. 01, No. 01" (2012). *Electro-Optics Newsletter*. 6.

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# EON

Volume 1, Issue 1

Fall 2012

## Electro-Optics News, University of Dayton

### Faculty

Partha Banerjee  
Brad Duncan  
Joseph Haus  
Peter Powers  
Andrew Sarangan  
Mikhail Vorontsov  
Qiwen Zhan

with

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Rola Aylo  
Monish Chatterjee  
Andy Chong  
Cong Deng  
Russ Hardie  
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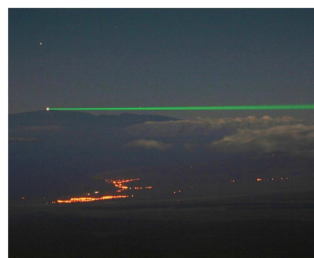
Editor: Partha P. Banerjee

## Director's corner

Welcome to Electro-Optics (EO) at UD, which just celebrated 100 years of Engineering. 2012 has been an eventful year thus far at EO. Dr. Joseph Haus stepped down as EO Director after 13 years at the helm. During his time, EO has grown in national and international prominence, especially with the establishment of LOCI, the Ladar and Optical Communication Institute, with funding from AFRL and various industry partners. Dr. Haus continues as LOCI Director and is going to be on a well-deserved sabbatical next year.

The newly established UD China Institute (UDCI) has EO lab facilities, which will be used for training potential Chinese EO students, and will provide a venue to offer several new regular/short courses. Typical new courses include Digital Holography,

Nanophotonics, Nanofabrication, and Propagation in Turbulent Media. A new nanotechnology course is being offered by Dr. Andrew Sarangan along with Sinclair Community College as part of a 2 year \$200K NSF grant. Dr. Mikhail Vorontsov, Wright



**Laser propagation through turbulence between Maui and the Big Island of Hawaii. This venue of Dr. Vorontsov's experiments for the recent MURI is attractive to faculty and students alike, especially during winter.**

Brothers Endowed Chair in EO, recently received a 5 year \$4.5M Multidisciplinary University Research

## Partha Banerjee

Initiative (MURI) for research on optical propagation through atmospheric turbulence. EO had over \$2.5M in research expenditures in 2011-12. Dr. Paul McManamon, technical director of LOCI, recently coauthored a seminal National Research Council study "Optics and Photonics—Essential Technologies for our Nation". Dr. Qiwen Zhan was promoted to full Professor. Dr. Brad Duncan is also serving as Associate Dean of the Graduate School. As part of Centennial celebrations, several

prominent researchers like Vlad Shalaev (Purdue), George Barbastathis (MIT), Sanjay Banerjee (Texas, Austin), Andy Steckl (Cincinnati) and Manijeh Razeghi

(Northwestern) visited UD, toured our facilities, and gave excellent colloquia to our students and faculty.

## Vorontsov wins \$4.5M AFOSR MURI award

The EO program has secured federal MURI funds from the Air Force Office of Scientific Research (AFOSR), funding that will lead to new jobs in UD.

UD will lead the \$4.5M project, which includes the Air Force Institute of Technology (AFIT), Michigan Tech University, North Carolina State University,

New Mexico State University and the University of Miami. UD ranks 23rd nationally in sponsored engineering research and development. "The AFOSR MURI contract is significant. It also is great for Dayton because much of the funds, 64%, and research will be at UD and AFIT," said Dr. Mikhail Vorontsov, PI for the MURI.

Vorontsov's research has already spun off a new company, OPTONICUS, which is housed in EO, and employs 10 researchers and students. It is expected to hire more in the near future. Along with OPTONICUS, 2 other small businesses, Defense Engineering Corporation (DEC) and Utopia Compression are setting up shop at EO.

## SPOTLIGHT: We'll leave the light on for you, Joe



At the reception following colloquia at Boll Theatre. (top) Dean Tony Saliba with Joe and Jianne Haus, and Nancy Wilson. (bottom) Joe with LiLi, Kong and Katte (l to r).

EO@UD was a young 15 years old when UD lured Dr. Joe Haus, from Rensselaer Polytechnic Institute to replace Mohammad Karim as the Director. Under Joe, EO expanded its PhD program, introduced new courses and labs, and greatly increased EO's research revenue. Joe co-founded IDCAST, the Institute for Development and Commercialization of Sensor Technology. Today IDCAST has its offices in downtown Dayton, and under Larrell Walters continues to attract and support organizations dedicated to sensor research. With IDCAST established and

growing, Joe turned his attention to setting up another research institute, this time in Ladars or laser radars. LOCI, the Ladar and Optical Communication Institute, was founded on financial contributions from AFRL and industry, and opened the door to creating the Wright Brothers Endowed Chair in EO, a position currently occupied by Mikhail Vorontsov. In all of this, Joe kept up his usual affinity to research, advised MS and PhD students, and collaborated with EO, Physics and ECE faculty, as well as researchers in the US, Mexico, and Italy.

In honor of Joe's stepping down as director, EO and ECE organized an afternoon of colloquia on Sept. 7, 2012 by eminent researchers as part of the Distinguished Speaker Series. The speakers were George Barbastathis (MIT), Shoji Tominaga (Chiba U., Japan), and Rajesh Naik (AFRL).

Simplicity is a virtue and Joe lives it. During travel, Joe would pick out Motel 6 at SPIE San Diego or a B&B at Photonics West San Francisco. We wish you the best in future endeavors, and promise to leave the *light* on for you.

**"The impact of optics and photonics on U.S. technology leadership is substantial; this is a critical reason to support a National Photonics Initiative."**

*Paul McManamon,  
LOCI, EO*

## McManamon gives NAC report on harnessing light

The technical director of EO LOCI is on the frontline with U.S. energy Secretary Steven Chu, former Intel CEO Craig Barrett, and researchers from Stanford and Northwestern to make lasers a focal point in boosting the U.S. economy and making revolutionary technical discoveries.

Dr. Paul McManamon is co-chair of the National Academy of Science (NAC) Committee on Harnessing Light: Capitalizing on Optical Science Trends and Challenges for Future Research. His role

recently took him to the White House where he presented the findings to the White House Office of Science and Technology Policy.

McManamon said optics and photonics touch nearly every aspect of our daily lives — communications, information processing and data storage, security, energy, health and medicine, manufacturing, advanced photonic measurements and applications, strategic materials for optics, and displays. Those are the eight areas the group identified for

further development. He also recommended the federal government develop a national initiative to bring academia, industry and government together for optics and photonics research opportunities. "The impact of optics and photonics on U.S. technology leadership is substantial; this is a critical reason to support a National Photonics Initiative," McManamon said.

*McManamon will present his findings at a EO-ECE Distinguished Speaker Colloquium on October 19, 2012.*

Paul McManamon (second from right) and Alan Willner (left), co-chair of the NAS report, along with Nobel prize winning Energy Secretary Stephen Chu (2nd from left), former CEO of Intel Craig Barrett (center), and Rich Linke, executive director for IEEE Photonics (right), on Sept. 12, 2012, at the office of Science and Technology Policy at the White House.



## Selected faculty, student journal publications 2012

P. Shah, Z. Wu, and A. Sarangan, "Effects of CO<sub>2</sub> critical point drying on nanostructured SiO<sub>2</sub> thin films after liquid exposure", *Thin Solid Films*, to appear.

X. Niu, P. Murray, and A. Sarangan, "Synthesis of Fe-Ni Bimetallic Nanoparticles from Pixel Target Ablation: Plume Dynamics and Surface Characterization", *J. Nanoparticle Research*, to appear.

G. Nehmetallah, R. Aylo, P. Powers, A. Sarangan, J. Gao, H. Li, A. Achari, and P. Banerjee, "Co-sputtered SiC + Ag nanomixtures as visible wavelength negative index metamaterials", *Opt. Exp.* **20**, 7095-7100 (2012).

R. Smith, A. Sarangan, Z. Jiang, and J. Marciante, "Direct measurement of bend-induced mode deformation in large-mode-area fibers", *Opt. Exp.* **20**, 4436-4443 (2012).

P. Banerjee, S. Buller, C. Leibig, G. Cook, D. Evans, P. Blanche, J. Thomas, and N. Peyghambarian, "Time dynamics of self-pumped reflection gratings in photorefractive polymers", *J. Appl. Phys.*, **111**, 013108 (2012).

P. McManamon, "Review of ladar: a historic, yet emerging, sensor technology with

rich phenomenology", *Opt. Engr.* **51**, 060901 (2012).

W. Chen, R. Nelson, and Q. Zhan, "Geometrical phase and surface plasmon focusing with azimuthal polarization", *Opt. Lett.* **37**, 581-583 (2012).

W. Chen, R. Nelson, and Q. Zhan, "Efficient miniature circular polarization analyzer design using hybrid spiral plasmonic lens", *Opt. Lett.* **37**, 1442-1444 (2012).

J. Gao, A. Sarangan, and Q. Zhan, "Polarization multiplexed fluorescence enhancer using a pixelated one-dimensional photonic band gap structure", *Opt. Lett.* **37**, 2640-2642 (2012).

G. Rui, R. Nelson, and Q. Zhan, "Beaming photons with spin and orbital angular momentum via a dipole-coupled plasmonic spiral antenna", *Opt. Exp.* **20**, 18819-18826 (2012).

G. Rui, W. Chen, D. Abeysinghe, R. Nelson, and Q. Zhan, "Beaming circularly polarized photons from quantum dots coupled with plasmonic spiral antenna", *Opt. Exp.* **20**, 19297-19304 (2012).

M. Aubailly and M. Vorontsov, "Scintillation resistant wavefront sensing based on multi-aperture phase recon-

struction technique", *J. Opt. Soc. Am. A*, **29**, 1707-1716 (2012).

M. Vorontsov, T. Weyrauch, S. Lachinova, M. Gatz, and G. Carhart, "Speckle-metric-optimization-based adaptive optics for laser beam projection and coherent beam combining", *Opt. Lett.*, **37**, 2802-2804 (2012).

R. Zhou, Q. Zhan, P. Powers, B. Ibarra-Escamilla, and J. W. Haus, "An all fiber based Talbot self-imaging device for phase-locking of a multi-fiber laser", *J. European Opt. Soc., Rapid Publications* **7**, 12012 (2012).

B. Nie, I. Saytashev, A. Chong, H. Liu, S. Arkhipov, F. Wise, and M. Dantus, "Multimodal microscopy with sub-30 fs Yb fiber laser oscillator", *Biomed. Opt. Exp.* **3**, 1750-1756 (2012).

W. Renninger, A. Chong, and F. Wise, "Pulse shaping and evolution in normal dispersion mode-locked fiber lasers", *IEEE J. Sel. Top. Quantum Electron.* **18**, 389-398 (2012).

R. Hardie and K. Barnard, "Fast super-resolution using an adaptive Wiener filter with robustness to local motion", *Opt. Exp.* **20**, 21053-21073 (2012).

## 2012 Graduates

Jennifer Carns, PhD

Jian Gao, PhD

Ross Bobb, MS

Marc Finet, MS

Sean McDaniel, MS

Samuel Venable, MS

Yu Wang, MS

**Congratulations!**

"The students will have as near a real-life experience as one could possibly offer without really entering the lab."

Andrew Sarangan,  
EO, ECE

## Sarangan wins NSF award for nanotech education

UD and Sinclair Community College have teamed up to encourage teenagers to pursue careers in nanotechnology. The National Science Foundation has given the two schools a two-year \$200,000 grant to raise awareness among undergraduates and high school students about career opportunities in the nanoscience industry.

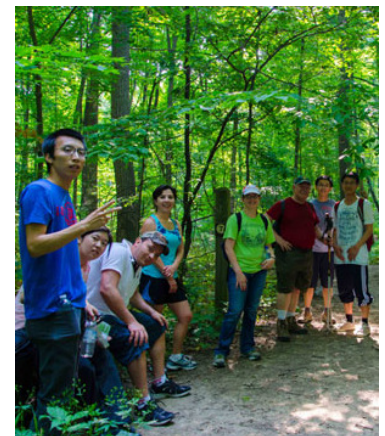
Dr. Andrew Sarangan, associate director, EO, and Surinder Jain, coordinator of Sinclair's

Engineering University Transfer program, are developing a program to connect high schools with industry partners, offer learning activities that include interactive laboratory and clean room experiences, provide workshops for high school science teachers and create nanotechnology internship opportunities.

"This is an important step for our local and national economy," Sarangan said. "After decades of outsourcing,

more and more nanotech manufacturing companies are starting to move back to the U.S. Long-term success of any industry needs everyone to be on board — science educators, researchers, engineers and technicians. That is the goal we are trying to reach, by partnering with every level in the workforce pipeline."

Classes are on this Fall with Sarangan and Joe Haus co-teaching the course at UD.



EO students and researchers hiking with Dr. Haus in Germantown Metropark, Spring 2012.





Institute for Development and Commercialization of Advanced Sensor Technology



Intelligent Optical Systems



EO is housed in College Park Center, which just got a \$1.6M facelift.



## EO @ UD

A joint initiative between electrons and photons

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## EO Program Highlights

- 16 faculty: EO (6), Phys (4), ECE (6); & 7 technical staff
- Offering over 20 courses, including 4 lab courses
- A constantly updated curriculum to address contemporary topics
- Over 15 dedicated research labs
- State-of-the-art nanofabrication facilities
- ~20 MS & ~20 PhD students
- Total research funding approx. \$3M/yr
- Close collaboration w/ AFRL
- LOCI: Ladar AF Ctr. of Excellence
- MURI lead institution in atmospheric propagation
- Offering excellent collaborative opportunities for incubation companies
- Collaboration with leading universities in US and China

### In the next issue:

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- Team bonding at MURI kickoff meeting
- Nanotech undergrad course: from the classroom

## Faculty, students receive awards, recognition



From top: Partha Banerjee, Han Li, Wei Han, and Qiwen Zhan.

**Partha Banerjee**, Professor of EO and Electrical & Computer Engineering (ECE), has recently been elected to Fellowship of the Institute of Physics (IoP) "in recognition of (his) personal contribution to the advancement of physics as a discipline and a profession." IoP is a leading international scientific society that originated in England in 1920 to advance physics research, application and education. Banerjee is the only faculty at UD to be bestowed with this honor. In addition, Banerjee also received the UD Alumni award for research, and the Dayton area Associated Societies Council Research Award in 2012. Banerjee's research interests include metamaterials, digital holography, nonlinear optics, and acousto-optics. He is also Fellow of

OSA and SPIE, and has authored 5 textbooks and over 100 refereed journal publications. He is topical editor of Applied Optics from 2009-2015.

**Wei Han**, EO PhD student, has been awarded the GPCE Dissertation Year Fellowship for 2012-13 academic year. Wei finished his MS thesis with Joe Haus on micropillar arrays. Currently, he is working on his PhD dissertation with Qiwen Zhan in the area of polarization engineering.

**Han Li**, a graduate student of EO, received the Newport—Spectra Physics Research Travel Award in 2012. This award was given to 10 students worldwide to travel to the SPIE Annual meeting and present their papers. Han Li's research interest is in the

area of metamaterials and numerical techniques for propagation through complex structures. His MS thesis and PhD dissertation advisor is Partha Banerjee.

**Qiwen Zhan**, Professor of EO and ECE, has been invited to serve as Chair of the Optical Society's Polarization technical group for a 3 year term. In addition, he is topical editor for Applied Optics. Recently, Zhan's paper on generating cylindrical vector beams was selected as one of the "Highlights of 2011" papers in OSA. Zhan also received a recent patent on Polarization engineering. *He will present a talk on "Hot topics in optical design, fabrication and instrumentation" in the upcoming FiO OSA Meeting at Rochester, NY.*