

CREOL, THE COLLEGE OF OPTICS AND PHOTONICS



UCF

**CREOL, The College of
Optics and Photonics**

UNIVERSITY OF CENTRAL FLORIDA

ANNUAL REPORT

2017

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MESSAGE FROM THE DEAN



CREOL, The College of Optics and Photonics, is one of the world's foremost institutions for research and education in optics and photonics. It started in 1987 as the Center for Research and Education in Optics and Lasers (CREOL) and became a graduate College in 2004, the first such college in the US. The College is home to the Florida Photonics Center of Excellence (FPCE), the Townes Laser Institute, and the Institute for the Frontier of Attosecond Science and Technology (iFAST).

The college has been an exciting place for students to have an outstanding educational experience and to engage in research in a broad spectrum of programs covering materials, devices, and systems, using technologies including lasers, optical fibers, optoelectronics and integrated photonics, nonlinear and quantum optics, as well as imaging, sensing and display. These technologies have applications in manufacturing, communication, biology and medicine, energy and lighting, and defense. Advanced topics such as nanophotonics, attosecond optics, plasmonics, and biophotonics are embraced as areas of strength and future growth. World-renowned for their scholarly contributions to fundamental and applied optics and photonics, the faculty have published 34 books and more than 4,000 journal papers with more than 100,000 citations. Many are recipients of prestigious national and international awards.

CREOL was initially founded to promote growth in optics and related fields in central Florida and has maintained this tradition over the years. We provide the well-trained workforce that keeps the industry growing and we partner with the Florida Photonics Cluster to coordinate this industry's efforts and needs. We also receive support from the Florida High Tech Corridor Council and Enterprise Florida. The CREOL Industrial Affiliates Program has attracted 201 different industrial members since its founding. The faculty have produced 307 patents, and spun off 28 photonics-based companies involving a wide variety of technologies.

Highlights of 2017 include the addition of new faculty members. Dr. Xiaoming Yu joined the college as Assistant Professor in Spring 2017. He received the Ph.D. from Kansas State University and his research focuses on laser-based advanced manufacturing, particularly ultrafast micro- and nano-fabrication. Dr. Ronald Driggers joined the faculty at the rank of Professor, with a part-time appointment at IMEC. Prior to coming to UCF, he was Superintendent of the Optical Sciences Division at the Naval Research Laboratory. An expert in electro-optical and infrared imaging system, and Founder and CEO of St. Jones Optical Systems, Driggers is Fellow of OSA and SPIE, and has been Editor-in-Chief of *Applied Optics* since January 2015. Kumar Patel joined the faculty as University Distinguished Professor (part time). Patel has made outstanding lifelong contributions to laser science and technology including the invention of the CO₂ laser.

The BS program, which began in Fall 2013, received accreditation from ABET. In AY 2016-17, 106 undergraduate and 132 graduate students were enrolled, and 15 Ph.D. degrees and 16 M.S. degrees were awarded. Graduate students continue to receive national scholarships, fellowships, travel grants, and best papers/poster awards. Ayman Abouraddy and Patrick LiKamWa were promoted

to Full Professor.

In 2017, Aravinda Kar became member of the National Academy of Inventors (NAI). Kathleen Richardson received the George W. Morey Award from the American Ceramic Society, and the Sir Richard Brook International Award from the European Ceramic Society. Sasan Fathpour became Fellow of OSA. At the university level, David Hagan received the Pegasus Professor Award, and Mercedeh Khajavikhan received the Reach for the Stars Award. At the college level, Khajavikhan received the Teaching Incentive Award and Sasan Fathpour received the Research Incentive Award, as well as the Excellence in Undergraduate Teaching Award. The Excellence in Graduate Teaching Award went to Axel Schülzgen and the Excellence in Research Award to Kathleen Richardson. Dennis Deppe and Winston Schoenfeld became members of the UCF Chapter of the National Academy of Inventors.

This year, the research conducted by the CREOL faculty, students, and scientists was disseminated nationally and internationally in 3 book chapters, 201 journal papers, including 23 papers in *Nature* journals, 2 in *Science* and 6 in *Optica*. Research and educational programs were funded by contracts and grants totaling approximately \$12M in FY 2017. Our tradition of innovation has also continued. In 2017, the faculty were inventors or co-inventors of 14 issued patents.

Partnership with industry continues to be strong. Approximately \$2.1M were received from industry or from federal grants flow through industrial partners, a connection that gives our students a leg up on industry positions after they graduate. The 2017 Industrial Affiliates Day events were attended by 275 guests and 23 exhibitors; the students presented 27 posters, and 4 short courses were offered. CREOL maintains an ongoing relation with its alumni and holds regular alumni reunions at key conferences. The CREOL Association of Optics Students (CAOS) has maintained its strong involvement in outreach and professional development. Another highlight of 2017 is the Florida Science Olympiad, which was held at UCF in March and in which CREOL was a key participant.

This annual report provides an overview of the education, research, and partnership activities of the faculty, staff, and students in 2017. Key data are also compared to previous years to show progress and identify trends. Academic data are reported for the academic year AY 2016–2017 (Summer 2016, Fall 2016, Spring 2017). Fiscal data, grants, and patents are reported for the fiscal year FY 2017 (July 2016–June 2017). Publications are reported for the 2017 calendar year. The report also highlights a number of selected research contributions. Information on more recent activities are reported regularly in the College's website <http://www.creol.ucf.edu/>. We hope you can find the information you need in this Annual Report or on the website.

Bahaa Saleh

FACULTY AND STAFF



Ayman F. Abouraddy

Professor of Optics and Photonics

Ph.D., Electrical Engineering, Boston University, 2003

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Research

Fabrication of multi-material micro-structured optical fibers, photonic band gap fibers, optical thermal, electric, and magnetic sensing using fibers, non-linear fiber optics, supercontinuum generation, mid-infrared fibers, chalcogenide glass fibers, fibers for solar applications, quantum optics and quantum information processing, optical generation of entangled states for sensing and imaging, nanowire and nanoparticle synthesis

Other Experience

- ▲ Postdoctoral Fellow, 2003-05, Research Scientist, 2005-08, Research Laboratory of Electronics (RLE), M.I.T.

Professional Activities

- ▲ Subcommittee member, CLEO, 2012-2013
- ▲ Program committee member, SPIE DSS, 2009

Honors and Awards

- ▲ Fellow, OSA 2016
- ▲ Research Initiative Award University-wide 2015
- ▲ Reach for the Stars Award 2014
- ▲ Teaching Incentive Program Award 2014



Rodrigo Amezcua Correa

Assistant Professor of Optics and Photonics

Ph.D., Optoelectronics, University of Southampton, 2009

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Research

Advanced optical fiber design and fabrication, photonic crystal fibers, fiber laser development, optical fiber devices and components, optical fiber sensors, nonlinear propagation in optical fibers, optical fiber for biomedical applications

Other Experience

- ▲ Laser Development Engineer, 2009-11, Powerlase Photonics
- ▲ Postdoctoral Researcher, 2007-09, University of Bath

Professional Activities

- ▲ Technical Committee Member, "2nd Workshop on specialty optical fibers and their applications", Oaxaca, Mexico

Honors and Awards

- ▲ Graduate Student Scholarship, , Mexico, 2004



Luca Argenti

Assistant Professor of Physics, Optics and Photonics

Ph.D., Chemistry, Scuola Normale Superiore of Pisa, Italy 2008

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Research

Ab initio and analytical description of the electronic continuum of atoms and molecules, theoretical photoelectron spectroscopy, attosecond transient-absorption spectroscopy, attosecond interferometric techniques for the reconstruction of electronic wave packets, transiently bound states, Auger decay, vibrational excitation in photoemission, intramolecular photoelectron scattering, double ionization.

Other Experience

- ▲ Post-Doctoral fellow at Stockholm University (2009-2010)
- ▲ Post-Doctoral fellow at Autonomous University of Madrid (2010-2016)

Professional Activities:

- ▲ Member of the organizing committee of the Intl. Spring School on New Computational Methods for Attosecond Molecular Processes (Zaragoza, 2015)
- ▲ Member of the international organizing committee of ICPEAC (Intl. Conf. Phot. El. & At. collisions) since 2015
- ▲ Member of the local organizing committee for XXIX ICPEAC (Toledo 2015)



Zenghu Chang

University Trustee Chair; Pegasus and Distinguished Professor of Physics, Optics and Photonics

Ph.D., Optics, Xi'an Institute of Optics & Precision Mechanics, 1988

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Research

Attosecond science, terawatt femtosecond laser, ultrafast atomic physics, coherent XUV and x-ray sources, high order harmonic generation, X-ray streak camera and other detectors, near and mid-infrared femtosecond sources.

Other Experience

- ▲ Director, Institute for the Frontier of Attosecond Science and Technology (iFAST)
- ▲ Ernest & Lillian Chapin Chair Prof., Kansas State Univ, 2009-10
- ▲ Professor, Department of Physics, Kansas State Univ, 2006-09
- ▲ Associate Prof. Dept. of Physics, Kansas State Univ, 2001-06
- ▲ Assistant Research Scientist, University of Michigan, 1999-01

Professional Activities

- ▲ Guest editor, J of Physics B., Attosecond special issue, 2012
- ▲ Co-chair, 5th Intl. Symposium, Ultra-fast Phenomena and THz Waves, China, 2010
- ▲ Co-chair, International Conf on Attosecond Phys, Kansas, 2009

Honors and Awards

- ▲ Fellow, APS, OSA
- ▲ Mercator Professorship, DFG, Germany, 2007
- ▲ Huber Schardin Gold Medal, 1996

**Demetrios Christodoulides**

Pegasus Professor of Optics and Photonics, Cobb Family Endowed Chair

Ph.D., Electrical Engineering, Johns Hopkins University, 1986

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Research

Nonlinear wave propagation, nonlinear optics, beam synthesis and dynamics, optical solitons, periodic and random optical structures, nonlinear optics in soft matter, quantum transport in arrays and photonic lattices.

Professional Activities

- ▲ QELS General Chair, 2014
- ▲ QELS Program Chair, CLEO/QELS, 2012
- ▲ Committee Chair, CLEO/QELS—QELS5, 2010-11

Honors and Awards

- ▲ Cobb Family Endowed Chair Professor
- ▲ OSA R.W. Wood Prize, 2011
- ▲ Fellow, OSA, APS
- ▲ ISI Highly Cited Researcher 2016
- ▲ UCF Pegasus Professor

**Peter J. Delfyett**

University Trustee Chair; Pegasus Professor of Optics and Photonics, EE, Physics; Director, Townes Laser Institute

Ph.D., Electrical Engineering, City University of New York, 1988

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Research

Fundamental ultrafast laser physics, ultrafast semiconductor lasers, stabilized optical frequency combs, optoelectronic device development, quantum dot based semiconductor devices for optical networks, ultrafast photonic networks and systems, optical clock distribution, synchronization & recovery, photonics ADC's and DAC's, coherent optical signal processing, DWDM, OTDM, and OCDMA Links

Other Experience

- ▲ Member of Technical Staff, Bell Communications Research
- ▲ President, National Society of Black Physicists
- ▲ Founder - Raydiance, Inc.

Professional Activities

- ▲ Board of Directors, OSA; Board of Governors, IEEE - LEOS
- ▲ Editor in Chief, IEEE J. Selected Topics in Quantum Electronics
- ▲ General Chair, CLEO; General Chair IEEE LEOS Annual Meeting
- ▲ Chair, APS – Division of Laser Science

Honors and Awards

- ▲ NSF Presidential Early Career Award for Scientists & Engineers
- ▲ Fellow, APS, IEEE, NAI, NSBP, OSA, SPIE
- ▲ APS Edward Bouchet Award
- ▲ UCF Pegasus Professor Award

**Dennis Deppe**

FPCE Endowed-Chair, Professor of Optics and Photonics

Ph.D., Electrical Engineering, University of Illinois, 1988

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Research

Semiconductor devices, epitaxial crystal growth, nano-structures, nanophotonics.

Other Experience

- ▲ ECE Department, UT Austin, 1990-05
- ▲ Member Technical Staff, AT&T Bell Laboratories, 1988-90

Professional Activities

- ▲ Guest Editor, IEEE JSQE, 1999
- ▲ Associate Editor, IEEE Photonics Letters, 1999-02
- ▲ Technical Program Committees, IEEE LEOS Annual Meeting, SPIE Photonics West, IEEE
- ▲ IEEE Semiconductor Laser Workshop Chair, 1998
- ▲ SPIE Conference Chair on VCSELs, 1997
- ▲ IEEE, LEOS Chair of the Semiconductor Laser Technical Committee, 99-02

Honors and Awards

- ▲ IEEE LEOS Engineering Achievement Award, 2003
- ▲ IEEE LEOS Distinguished Lecturer Award, 2001-02
- ▲ Fellow, IEEE, OSA
- ▲ OSA Nicholas Holonyak Award 1999
- ▲ NSF Presidential Young Investigator Award, 1991
- ▲ ONR Young Investigator Award, 1991

**Aristide Dogariu**

Pegasus Professor of Optics and Photonics

Ph.D., Engineering, Hokkaido University, Japan, 1994

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Research

Optics of complex media, waves propagation and scattering, statistical optics, optical sensing and imaging, near field optics, biophotonics, optical systems analysis, modeling, and design.

Other Experience

- ▲ Chair, "Mesoscale Photonics Incubator Meeting", OSA, 2012
- ▲ Chair, "Computational Optical Sensing and Imaging", OSA, 2009
- ▲ Chair, Topical Meeting "Computational Optical Sensing and Imaging", OSA, 2007
- ▲ Chair Biosensing Committee, "Topical meeting Coherent Optical Technologies and Applications", OSA, 2006
- ▲ Chair, Topical Meeting "Photon Correlation and scattering", OSA, 2004

Professional Activities

- ▲ Division Editor, Applied Optics - Optical Technology
- ▲ Member OSA Board of Editors
- ▲ Editorial Board: Journal of Holography and Speckle

Honors and Awards

- ▲ Fellow, APS, OSA
- ▲ Florida Photonics Center of Excellence (FPCE) Professorship
- ▲ UCF Pegasus Professor

**Ronald Driggers**

Professor of Optics and Photonics

Ph.D., Electrical Engineering, University of Memphis, 1990

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Research

Imaging systems, sensors, and components. Applications include target acquisition, intelligence-surveillance-reconnaissance (ISR), threat warning, and mobility (including degraded visual environments). Atmospheric, optics, detectors, signal and image processing, displays, and human vision.

Other Experience

- ▲ Superintendent, Optical Sciences Division, Naval Research Laboratory
- ▲ Chief, Electro-Optics and Photonics Division, Army Research Laboratory
- ▲ Director, Modeling and Simulation Division, Army Night Vision Laboratory

Professional Activities

- ▲ Editor-In-Chief, Applied Optics
- ▲ Board of Editors, Optical Society of America
- ▲ Conference Committee, SPIE Defense and Security
- ▲ Executive Committee, Military Sensing Symposium
- ▲ Past Editor-in-Chief of Optical Engineering
- ▲ Past Board of Directors SPIE

Honors and Awards

- ▲ US Army Engineer of the Year 2002
- ▲ CERDEC Technical Employee of the Year 2001
- ▲ Night Vision Laboratory Employee of the Year 2000
- ▲ US Navy Engineering Duty Officer of the Year 2001
- ▲ University of Memphis Alumni of the Year 2010
- ▲ Fellow SPIE, OSA, MSS

**Sasan Fathpour**

Associate Professor of Optics and Photonics, ECE

Ph.D., Electrical Engineering, University of Michigan, 2005

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Research

Integrated photonics, heterogeneous integration in silicon photonics, Integrated nonlinear optics, semiconductor optoelectronics.

Other Experience

- ▲ Senior Researcher, Ostendo Technologies, Carlsbad, CA 2008
- ▲ Visiting Assistant Professor, Electrical Engineering Dept., UCLA 2007
- ▲ Postdoctoral Research Fellow, Electrical Engineering Dept., UCLA, 2005-07

Professional Activities

- ▲ Fellow of OSA and Senior Member of IEEE and SPIE
- ▲ Chair of Short Courses at the Conference on Lasers and Electro-Optics (CLEO), 2014-16
- ▲ Symposium Co-Chair, "Emerging Materials and Devices for on-chip Optoelectronics," MRS Fall Meeting 2015
- ▲ Guest Editor of SPIE's Journal of Nanophotonics Special Issue on Nanophotonics

Honors and Awards

- ▲ Fellow of OSA, The Optical Society, 2017
- ▲ UCF Research Incentive Award (RIA), 2017
- ▲ UCF Reach for the Stars Award, 2015
- ▲ ONR Young Investigator Award, 2013
- ▲ UCF Teaching Incentive Program (TIP) Award, 2013
- ▲ College of Optics and Photonics Excellence in Graduate Teaching Award, 2013
- ▲ NSF CAREER Award, 2012
- ▲ UCLA Chancellor's Award for Postdoctoral Research, 2007

**Romain Gaume**

Assistant Professor of Optics and Photonics, NanoScience Technology

Ph.D., Materials Science, Paris VI University, France, 2002

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Research

Fabrication of transparent ceramics: powder processing, shaping and sintering, applications of transparent ceramics to lasers and scintillators, gain-engineered solid state lasers, nuclear and radiological scintillation detectors, thermoelectric ceramic materials

Other Experience

- ▲ Postdoctoral Research scientist, Applied Physics Dept., Stanford University 2002-06
- ▲ Research Scientist, Applied Physics Dept., Stanford University, 2006-11

Professional Activities

- ▲ Member, ACerS, OSA

Honors and Awards

- ▲ Dissertation Thesis Award, 2002.

**Ryan M. Gelfand**

Assistant Professor of Optics and Photonics

Ph.D., Electrical Engineering, Northwestern University, 2013

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<http://nbpl.creol.ucl.edu>**Research**

Near-field optics, Aperture based optical trapping, Plasmonic trapping, Single protein spectroscopy, Protein biophysics, dynamics, and behavior, Fiber optic biosensing device development, Protein assay development, Compact optical based biosensors, Pharmaceutical treatment testing for proteopathy diseases

Other Experience

- ▲ NSF post-doctoral fellowship in Biology, University of Victoria, 2013 – 2015

Professional Activities

- ▲ Member – OSA, SPIE
- ▲ Program Committee – SPIE Biosensing and Nanomedicine

Honors and Awards

- ▲ NSF Postdoctoral Fellowship in Biology
- ▲ Northwestern Terminal Year Fellowship
- ▲ SPIE Scholarship in Optics and Photonics

**Leonid B. Glebov**

Research Professor of Optics and Photonics
Ph.D., Physics, State Optical Institute, Leningrad,
1976

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Research

Optical properties of glasses, photosensitive glasses for hologram recording, nonlinear phenomena, including laser-induced damage, holographic optical elements, high Power laser systems.

Other Experience

- ▲ Founder, Vice President and CTO of OptiGrate Corporation

Professional Activities

- ▲ Member, American Ceramic Society
- ▲ Member, Directed Energy Professional Society

Honors and Awards

- ▲ Dennis Gabor Award in Holography
- ▲ Fellow; SPIE, OSA, ACS, NAI
- ▲ Florida Photonics Center of Excellence (FPCE) Professorship

**David J. Hagan**

Associate Dean of Academic Programs; Professor
of Optics and Photonics, Physics
Ph.D., Physics, Heriot Watt University, 1985

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Research

Nonlinear optics, fundamental limits for nonlinear optical coefficients, nonlinear optical switching, semiconductors and quantum dots, organics and polymers, optical limiting and suppression, ultrasensitive techniques for measuring optical nonlinearities, ultrafast spectroscopy.

Other Experience

- ▲ Founder, Polara, LLC.
- ▲ Photonics consultant, National Research Council "Defense After Next"

Professional Activities

- ▲ Executive Editor-in-Chief, Chinese Optics Letters
- ▲ Editor-in-Chief, Optical Materials Express (2010-15)
- ▲ Topical Editor, J. Opt Soc. Am B., (2006-10)
- ▲ Principal Editor, Journal of Materials Research (2001-06)
- ▲ Chair, OSA Nonlinear Optics meeting (2017)
- ▲ Chair, Frontiers in Optics (2015)
- ▲ Senior Member, IEEE

Honors and Awards

- ▲ Fellow, OSA, SPIE
- ▲ Ranked by ISI as "Highly Cited Researcher"

**Kyu Young Han**

Assistant Professor of Optics and Photonics
Ph.D., Chemistry, Seoul National University, Korea
2010

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Research

Development and applications of fluorescence nanoscopy (super-resolution fluorescence imaging), fluorescent tags, single-molecule fluorescence imaging, label-free imaging techniques to study essential problems in biology and neuroscience.

Other Experience

- ▲ Postdoctoral Fellow, Department of Physics and Howard Hughes Medical Institute, University of Illinois, Urbana, IL (2011 – 2015)
- ▲ Visiting Student, Department of NanoBiophotonics, Max Planck Institute for Biophysical Chemistry Göttingen, Germany (2007 – 2010)

Professional Activities

- ▲ Program session chair: SPIE Biosensing and Nanomedicine IX (08/2016)
- ▲ Journal reviewer: eLife, Nature Methods, Nanoscale, J Phys D
- ▲ Journal Advisory Panel, Journal of Physics D: Applied Physics

Honors and Awards

- ▲ Max Planck Institute Fellowship (2008-2010)
- ▲ International Research Collaboration Fellowship (KRF, 2007-2008)
- ▲ Korea Science and Engineering Foundation Scholarship (2005)

**Aravinda Kar**

Professor of Optics and Photonics, MMAE, EECS,
Physics

Ph.D., Nuclear Engineering, University of Illinois at
Urbana-Champaign, 1985

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Research

Laser-Advanced materials Science (LAMS), lasers in manufacturing (LIM), thermal science for LAMS and LIM, laser and optical science and technology, process modeling and diagnostics, semiconductor and optoelectronic materials processing, materials synthesis and development of new materials, medical materials, novel sensors, detectors and light-emitters

Other Experience

- ▲ Interdisciplinary science and technology
- ▲ Cross disciplinary courses (thermal science, materials and optics)
- ▲ Technology transfer from research to industrial implementation

Professional Activities

- ▲ Member, LIA
- ▲ Editorials Board Member

Honors and Awards

- ▲ Fellow, LIA
- ▲ Numerous Patents

**Mercedeh Khajavikhan**

Assistant Professor of Optics and Photonics

Ph.D., Electrical Engineering, University of Minnesota, 2009

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Research

Nanophotonics, applied electromagnetic, laser physics, quantum optics, non-Hermitian photonics, silicon photonics, and plasmonics.

Other Experience

- ▲ Post-Doctoral Researcher, University of California, 2009-11
- ▲ Staff Researcher, University of California, 2012

Professional Activities

- ▲ Topical Editor: Optics Express
- ▲ Member: OSA, SPIE, IEEE
- ▲ Committee member: CLEO-QELS 2015-2017, SIAM 2015, Meta Conference 2017
- ▲ Reviewer: Nature, Science, Nature Communications, Optica, Optics Letters, Optics Express, Applied Physics Letters, IEEE Photonics Technology Letters

Honors and Awards

- ▲ Norton Fellowship for Academic Excellence, University of Minnesota, 2005
- ▲ NSF Early CAREER Award, 2015
- ▲ Excellence in Graduate Teaching Award- UCF CREOL, 2016
- ▲ ONR Young Investigator Award, 2016

**Pieter G. Kik**

Associate Professor of Optics and Photonics, Physics

Ph.D., Physics, FOM Institute of Atomic Molecular Physics, Amsterdam (AMOLF), 2000

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Research

Nanophotonics and near-field optics, near-field scanning optical microscopy, nanostructured optical waveguides, nanolithography, tunable plasmon optical nanosensors for biochemical detection, numerical modeling of nanophotonic integrated circuits, surface enhanced Raman spectroscopy, rare earth doped optical materials, waveguide amplifiers

Other Experience

- ▲ Post-Doctoral Researcher, California Institute of Technology, 2001-03

Professional Activities

- ▲ Member, OSA, MRS

Honors and Awards

- ▲ 2014 Excellence in Graduate Teaching Award (College Level)
- ▲ 2009 Teaching Incentive Award Program
- ▲ 2008 Excellence in Graduate Teaching Award (College Level)
- ▲ 2007 NSF Career Award

**Stephen Kuebler**

Associate Professor of Chemistry, Optics and Photonics

D.Phil, Chemistry, University of Oxford, 1998

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Research

Laser-based patterning and material processing, laser beam shaping, nanophotonic structures and devices, 3D nano and microfabrication, nonlinear optical materials.

Other Experience

- ▲ Assistant Staff Scientist, Chemistry, University of Arizona, 2001-03
- ▲ Research Associate, Chemistry, University of Arizona, 1999-01
- ▲ Post-Doctoral Researcher, California Institute of Technology, 1998-99

Professional Activities

- ▲ Interm Assistant Vice-President of Research and Commercialization (2012-2013)
- ▲ Editorial Board, J. of Micro/Nanolithography, MEMS, and MOEMS
- ▲ Editorial Board, Journal of Experimental Nanoscience
- ▲ Member, MRS, OSA, ACS
- ▲ Senior Member, SPIE
- ▲ Chair, Orlando Section of the American Chemical Society, 2012
- ▲ Marshall Scholarship Selection Committee, Atlanta Region (2009-2013)

Honors and Awards

- ▲ NSF CAREER Award, January 2008
- ▲ Teaching Incentive Program Award, UCF, 2008 & 2014
- ▲ Excellence in Undergraduate Teaching Award, College of Sciences, UCF, 2008 & 2015
- ▲ Marshall Scholar, Assoc. of Commonwealth Universities, UK, 1991
- ▲ NSF Graduate Fellowship, 1993
- ▲ Barry Goldwater Fellowship for physical sciences, 1989

**Guifang Li**

Professor of Optics and Photonics, Physics, EECS

Ph.D., Electrical Engineering, University of Wisconsin-Madison, 1991

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Research

Fiber-optic transmission systems, all-optical signal processing, free-space optical communication, optical networking, fiber optics, microwave photonics, coherent detection and imaging.

Other Experience

- ▲ Nonlinear surface polaritons
- ▲ Phase conjugation
- ▲ Nonlinear dynamics

Professional Activities

- ▲ Deputy Editor, Optics Express
- ▲ Associate Editor, IEEE Photonics Technology Letters

Honors and Awards

- ▲ ONR Young Investigator Award, 1995
- ▲ NSF CAREER Award, 1996
- ▲ IEEE EDS Distinguished Lecturer
- ▲ Fellow, OSA, SPIE
- ▲ Florida Photonics Center of Excellence (FPCE) Professorship



Patrick L. LiKamWa

Professor of Optics and Photonics, ECE

Ph.D., Electronic & Electrical Engineering, University of Sheffield, UK, 1987

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Research

Optoelectronics, integrated optics devices with gain using resonant nonlinearities, novel semiconductor nanostructures for advanced optoelectronics, implement monolithic all-Optical switching circuits, multi-platform integration using multilayer dielectric films for integrated, integrated optic bio-sensors, monolithically integrated wavelength tunable optical emitters

Other Experience

- ▲ Plasmonic waveguiding devices
- ▲ Fiber optic sensors

Professional Activities

- ▲ Senior Member, IEEE/LEOS

Honors and Awards

- ▲ IEEE/LEOS Orlando Chapter Engineer of the Year
- ▲ UCF Teacher Incentive Program
- ▲ College of Optics Excellence in Graduate Teaching Award



M. G. "Jim" Moharam

Professor of Optics and Photonics

Ph.D., EE, University of British Columbia, Canada, 1978

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Research

Diffraction holographic optics, Integrated photonics grating based devices, computational photonics, theory and analysis of periodic structures, subwavelength periodic structures and devices, guided-waves grating resonant devices, analysis and design artificial metamaterial devices, novel integrated antireflective surfaces, grating based plasmonic structures.

Other Experience

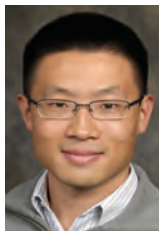
- ▲ Wave propagation in periodic and anisotropic media
- ▲ Analysis and design of optical filters
- ▲ Thin film optics

Professional Activities

- ▲ Topical Editor - JOSA - A
- ▲ Conference Chair, Topical meeting on diffractive optics
- ▲ Program Committee, SPIE Europe

Honors and Awards

- ▲ Fellow, OSA
- ▲ Senior Member, IEEE
- ▲ UCF Graduate Teaching Award



Shuo "Sean" Pang

Assistant Professor of Optics and Photonics

Ph.D., Electrical Engineering, Caltech 2013

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Research

Computational imaging, Optical imaging, X-ray imaging, Biophotonics: microscopy, Optical design, Microfluidics and Micro total analysis system

Professional Activities

- ▲ Chair, Microscopy and OCT Technical Group, OSA
- ▲ Member, SPIE



Kumar Patel

University Distinguished Professor of Optics and Photonics

Ph.D., Electrical Engineering, Stanford University, 1961

Chandra.Patel@ucf.edu

Research

Optics and laser physics and technology; infrared nonlinear optics

Other Experience

- ▲ Founder, President, and CEO of Pranalytica, Inc. (2000-present)
- ▲ Vice Chancellor for Research, UCLA (1993-1999)
- ▲ Executive Director, Physics Division and Materials Research Division, AT&T (now Lucent Technologies) Bell Laboratories (1961-1993)

Professional Activities

- ▲ Honorary Member, Gynecologic Laser Surgery Society (1980)
- ▲ Honorary Member, American Society for Laser Medicine and Surgery (1985)
- ▲ Board of Directors, Newport Corporation

Honors and Awards

- ▲ Optical Society Adolph Lomb Medal (1966) and Townes Medal (1976), Frederic Ives Medal (1989)
- ▲ IEEE Medal of Honor (1989)
- ▲ APS George E. Pake Prize (1988)
- ▲ New Jersey Governor's Thomas Alva Edison Science Award (1987)
- ▲ National Academy of Engineering (1978) and the National Academy of Science (1974)
- ▲ Coblentz Prize (American Chemical Society, 1974)
- ▲ IEEE Lamme Medal (1976)
- ▲ National Inventors' Hall of fame (2012)
- ▲ National Medal of Science awarded by President Bill Clinton (1996)
- ▲ Fellow, IEEE, APS, OSA, American Academy of Arts and Sciences, AAAS, LIA, ASLMS

**C. Kyle Renshaw**

Assistant Professor of Optics and Photonics
Ph.D., Applied Physics, University of Michigan, 2014

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Research

Thin-film optoelectronics, Organic LEDs, Solar Cells and Sensors, Perovskite LEDs, Lasers and Photovoltaics, Hybrid organic/inorganic materials and devices, Thin-film transistors, Flexible electronics, Nanofabrication, Large area optoelectronics

Other Experience

- ▲ Physicist, Advanced Technology Center, Northrop Grumman Corp., 2013-2015

Professional Activities

- ▲ Member, Materials Research Society

**Kathleen A. Richardson**

Professor of Optics and Photonics, Material Science and Engineering
Ph.D., Ceramics, Alfred University, 1992

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Research

Infrared optical glass and glass ceramics, photosensitive infrared materials, integrated MIR Planar sensors, optics manufacturing science, mid-infrared optical metrology, precision glass molding (PGM), graded index optical materials

Professional Activities

- ▲ Past President, American Ceramic Society
- ▲ Member, Board of Trustees, Ceramic and Glass Industry Foundation (CGIF)
- ▲ Curator, Ernst Abbe Fund Board of Trustees, Deutsches Stiftung
- ▲ Member, External Advisory Board, Savannah River National Laboratory
- ▲ Member, Board of Trustees, Alfred University

Honors and Awards

- ▲ Sir Richard Brook International Award, European Ceramic Society, 2017
- ▲ George W. Morey Award, American Ceramic Society, 2017
- ▲ Malcolm G. McClaren Distinguished Lecturer Award, Rutgers University Department of Materials Science and Engineering, 2017
- ▲ Fellow, OSA, SPIE, ACerS and SGT
- ▲ Academician, World Academy of Ceramics, 2015
- ▲ I.D. Varshnei Award, Indian Ceramic Society
- ▲ Outstanding Educator Award, American Ceramic Society
- ▲ Samuel R. Scholes Lecture and Award, Alfred University

**Martin C. Richardson**

FPCE Trustee Chair; Northrop Grumman Prof. of X-ray Photonics; Pegasus Professor of Optics and Photonics, Physics, ECE

Ph.D., Physics, London University, 1967

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Research

Laser system development, femtosecond laser-aided materials processing, laser-induced-breakdown spectroscopy (LIBS), biological x-ray microscopy, laser medicine, optical tweezers, physics of laser plasmas, plasma & radiation modeling - X-ray sources, ultra-fast X-ray production; interaction with matter diffraction studies, X-ray and EUV optics, laser plasma EUV sources for lithography, high energy lasers, solid state lasers, high power fiber lasers development & High power ultrafast lasers, laser spectroscopy and sensing

Professional Activities

- ▲ Member, SPIE, APS, Program Committee; LEOS
- ▲ Directed Energy Consortium (UCF rep.), 2003
- ▲ Member, Expert Review Panel - Canadian Institute for Photonic Innovations, Canadian Govt.

Honors and Awards

- ▲ UCF Pegasus Professor Award
- ▲ SPIE Harold E. Edgerton Award
- ▲ Fellow, OSA, IEEE, SPIE, APS
- ▲ Schardin Medal

**Bahaa E. A. Saleh**

Dean & Director, Professor of Optics and Photonics

Ph.D., Electrical Engineering, Johns Hopkins University, 1971

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Research

Nonlinear and quantum optics quantum information processing, coherence and statistical optics, optical imaging and sensing

Other Experience

- ▲ Chair of ECE, Boston University, 1994-07
- ▲ Chair of ECE, University of Wisconsin-Madison, 1990-94
- ▲ Assoc. Director, ERC Center for Subsurface Imaging, 2000-09

Professional Activities

- ▲ Member, Board of Directors, LIA, 2011-present
- ▲ Founding Editor, *Advances in Optics and Photonics*, 2008-present
- ▲ Editor, *Journal of Optical Society of America A*, 1991-97
- ▲ Author, *Introduction to Subsurface Imaging*, Cambridge 2011
- ▲ Co-author of *Fundamentals of Photonics*, Wiley, 2nd ed., 2007
- ▲ Author, *Photoelectron Statistics*, Springer, 1978

Honors and Awards

- ▲ OSA Mees Medal, 2013
- ▲ OSA Distinguished Service Award, 2009
- ▲ OSA Esther Hoffman Beller Medal, 1999
- ▲ Kuwait Prize, 2006
- ▲ SPIE BACUS Prize, 2004
- ▲ Fellow, IEEE, OSA, SPIE
- ▲ Fellow; Guggenheim Foundation

**Winston V. Schoenfeld**

Professor of Optics and Photonics

Ph.D., Materials Science, Univ. of California, Santa Barbara, 2000

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Research

MBE growth of oxide semiconductors, oxide and nitride semiconductor UV detectors, advanced passivation and cell architectures for c-Si photovoltaics

Other Experience

- ▲ Director, cSi Photovoltaic Manufacturing Consortium (PVMC) 2011-17
- ▲ President/CEO, Medical Lighting Solutions, 2003-04
- ▲ Device Manager, Uniroyal Optoelectronics, 2000-03

Professional Activities

- ▲ Member, SPIE, OSA, IEEE
- ▲ Principal Editor, Journal of Materials Research
- ▲ Chair, MOEMS/MEMS Conference – SPIE Photonics West
- ▲ Energy Sub-Committee Member, National Photonics Initiative (NPI), 2013
- ▲ NSF Research Experience for Undergraduates Program PI, 2005-11

Honors and Awards

- ▲ Fellow, SPIE
- ▲ UCF RIA Award for Research Excellence, 2016
- ▲ UCF ORC Millionaire Award, 2013/2014/2015
- ▲ UCF Innovator, 2013/2014
- ▲ UCF TIP Award for Teaching Excellence, 2010
- ▲ UCF Presidential Initiative Award, 2006

**Axel Schülzgen**

Professor of Optics and Photonics

Ph.D., Physics, Humboldt University, Berlin, 1992

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Research

Fiber laser devices, fiber optic sensors, linear and nonlinear light propagation in fiber, nanostructured and functionalized fibers, design and fabrication of specialty optical fiber, advanced optical materials, linear and nonlinear optical spectroscopy

Other Experience

- ▲ College of Optical Sciences, The University of Arizona, 1996-09
- ▲ Department of Physics, Trinity College, Dublin, Ireland, 1995
- ▲ Department of Physics, Humboldt University, Berlin, Germany, 1991-95

Professional Activities

- ▲ Member, OSA, SPIE, German Physical Society
- ▲ Topical Editor, Applied Optics, 2010-2016
- ▲ Guest Editor, JOSA B, 2016/2017
- ▲ Program Committee CLEO, OFC, SOF, FILA

Honors and Awards

- ▲ Excellence in Graduate Teaching Award, 2017
- ▲ CREOL Excellence in Research Award, 2015
- ▲ Habilitation Fellowship, German Research Foundation, 1993
- ▲ Carl Ramsauer-Magnus Award, AEG Corporation, 1992
- ▲ Heinrich Gustav - Magnus Award, Humboldt University, Berlin, 1988

**Lawrence Shah**

Research Assistant Professor of Optics and Photonics

Ph.D., Physics, University of Central Florida, 2001

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Research

Fiber Laser, ultrafast lasers, thin disk lasers, nonlinear optics for wavelength generation in the near-and mid-IR, laser materials processing.

Other Experience

- ▲ Post doc, Lawrence Livermore National Laboratory, 2001-02
- ▲ Application Development and Laser Development Research Scientists, IMRA America Inc, 2002-08
- ▲ Senior Research Scientists, Laser Plasma Laboratory, 2008-12

Professional Activities

- ▲ Member, SPIE, OSA
- ▲ Assistant Editor for IEEE Journal of Quantum Electronics
- ▲ Topical Editor for Optics Letters

**M.J. Soileau**

University Distinguished Professor of Optics and Photonics, ECE, Physics

Ph.D., Quantum Electronics, University of Southern California, 1979

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Research

Nonlinear optical properties of materials, laser-induced damage; Laser-induced damage to optical materials, nonlinear refraction nonlinear absorption; Sensor protection

Other Experience

- ▲ Officer, USAF, 1967-73
- ▲ Physicist, Naval Weapons Center Physics Div., China Lake, 1973-80
- ▲ Professor of Physics, North Texas State University, 1980-87
- ▲ Director, School of Optics/CREOL, 1987-99
- ▲ Chair of the Board, Orlando Science Center, 2002
- ▲ Technology-Based Economic Development; Technology Transfer
- ▲ Board of Directors, BEAM, Inc.; Board of Directors, Aquafibe

Professional Activities

- ▲ President, SPIE, 1997
- ▲ Co-Chair, SPIE Boulder Damage Symposium

Honors and Awards

- ▲ Director's Award, SPIE, 1999
- ▲ Fellow, OSA, IEEE, SPIE, AAAS, NAI; Senior Member, LIA
- ▲ Outstanding Engineer Award, State of Florida, 1994
- ▲ SPIE Gold Medal
- ▲ OSA Esther Hoffman Beller Award
- ▲ Distinguished Service Medal, ICFO, Barcelona, Spain
- ▲ EDC Chairman's Award, 2014
- ▲ Florida Inventors Hall of Fame
- ▲ Foreign Member of the Russian Academy of Science

**Eric W. Van Stryland**

Pegasus Professor of Optics and Photonics,
Trustee Chair, and Founding Dean

Ph.D., Physics, Optical Sciences Center, University of
Arizona 1976

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nlo.creol.ucf.edu

Research

Develop NLO spectroscopic techniques, e.g. Z-scan, measure nonlinear absorption spectra, e.g. two-photon absorption, 2-photon gain, 2PA, measure nonlinear refraction dispersion, e.g. bound electronic n₂, model material nonlinearities, 2PA, n₂, excited-state absorption, etc., measure ultrafast NLO response and temporally resolve, develop nonlinear devices - e.g. widegap IR detectors using 2PA

Other Experience

- ▲ Dean, CREOL, The College of Optics and Photonics, 2004-09
- ▲ Director, School of Optics/CREOL, 1999-04
- ▲ Visiting Professor, Heriot-Watt University, 1985
- ▲ Chair, Center for Applied Quantum Electronics, U. of N. Texas, 1983-86
- ▲ Center for Laser Studies, University of South California, 1976-78

Professional Activities

- ▲ President, Optical Society of America (OSA), 2006, Board of Directors,
- ▲ Fellow, OSA, SPIE, IEEE, APS
- ▲ Senior member, LIA (Board of Directors)
- ▲ Topical Editor, Optics Letters, 1994-98

Honors and Awards

- ▲ UCF Pegasus Professor Award, 2003
- ▲ UCF Researcher of the Year, 1990 and 2009; R&D 100 Award, 2001
- ▲ ISI Highly Cited Author
- ▲ OSA R. W. Wood Prize, 2012

**Konstantin L. Vodopyanov**

21st Century Scholar Chair and Professor of
Optics and Photonics

Ph.D., Physics, Lebedev Physical Institute, Moscow,
1983

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mir.creol.ucf.edu

Research

Mid-Infrared Combs Group (MIR). Broadband mid-infrared ($\lambda > 2.5 \mu\text{m}$) frequency combs generation based on subharmonic optical parametric oscillators. Trace molecular sensing and coherent dual-comb spectroscopy using octave-wide MIR combs. Biomedical applications of frequency combs. Photonic THz wave generation and THz imaging. Nano-IR spectroscopy.

Other Experience

- ▲ Stanford University (2003-2013)
- ▲ Inrad Inc., Picarro Inc., USA (1999-2003)
- ▲ Imperial College, London, UK (1992-1998)
- ▲ University of Bayreuth, Germany (1990-1992)
- ▲ Moscow Inst. of Physics and Technology (1985-1990)
- ▲ Lebedev Physical Inst., Moscow (1983-1990)

Professional Activities

- ▲ General Chair, Inst. Symp. On Photodetection and Imaging (ISPD), Beijing, China, 2013
- ▲ Photonics West, LA106 Conference Chair (2010-present)
- ▲ CLEO General Chair, 2010, CLEO Program Chair, 2008
- ▲ Associate Editor, Optica
- ▲ Co-author, Solid-State Mid-Infrared Laser Sources, Springer, 2003

Honors and Awards

- ▲ Fellow, OSA, SPIE, APS
- ▲ Fellow, UK Institute of Physics (IOP)
- ▲ Alexander-von-Humboldt Fellow, Germany, 1990

**Shin-Tson Wu**

Pegasus Professor of Optics and Photonics

Ph.D., Physics, University of Southern California, 1981

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Research

Advanced displays including LCDs, OLEDs, augmented reality and virtual reality, adaptive lenses, and adaptive optics.

Other Experience

- ▲ Senior Scientist, Hughes Research Labs

Professional Activities

- ▲ Chair, SID Honors and Awards Committee
- ▲ Founding Editor-In-Chief, IEEE/OSA Journal Display Technology

Honors and Awards

- ▲ 2014 Florida Inventors Hall of Fame
- ▲ 2014 OSA Esther Hoffman Beller Medal
- ▲ 2012 NAI Fellow
- ▲ 2011 SID Slottow-Owaki Prize
- ▲ 2010 OSA Joseph Fraunhofer Award
- ▲ 2008 SPIE G.G. Stokes Award
- ▲ 2008 SID Jan Rajchman Prize
- ▲ Fellow, OSA, SPIE, IEEE, SID

**Xiaoming Yu**

Assistant Professor of Optics and Photonics

Ph.D., Industrial and Manufacturing Systems Engineering, Kansas State University, 2016

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<https://sites.google.com/site/yulabucf2/>

Research

Developing novel for laser-based advanced manufacturing, and seeking fundamental understanding of light-matter interaction. Research interests include laser-induced nonequilibrium, electron dynamics control, ultrafast laser micro/nano processing, and laser-based additive manufacturing.

Other Experience

- ▲ Session Chair for conferences MSEC 2017, IMECE 2017

**Boris Y. Zeldovich**

Professor of Optics and Photonics, Physics

Ph.D., Physics, Institute of Theoretical and Experimental Physics, Moscow, 1969

boris@creol.ucf.edu | (407) 823-6831

Research

Physical optics and propagation, Electrodynamics of Volume Bragg Gratings, beam clean-up and combining via nonlinear-optical processes, nonlinear optics, including liquid crystals.

Other Experience

- ▲ Vice President, Beam Engineering for Advanced Measurements Co., Winter Park, FL
- ▲ Head, Joint Nonlinear Optics Lab, Electrophysics Institute of the Russian Academy of Sciences and Chelyabinsk Technical University, Russia, 1987-94
- ▲ Principal Senior Scientific Researcher, Inst. for Problems in Mechanics, Moscow, 1981-87
- ▲ Lecturer on Nonlinear & Statistical Optics, Moscow Institute for Physics and Technology, 1969-1987

Professional Activities

- ▲ Editorial Board Member, Optics Communications; Pure & Applied Optics; Optical and Quantum Electronics; International Journal of Nonlinear Optical; Physics & Materials Topical Editor, J. Optical Society of America B

Honors and Awards

- ▲ Max Born Award, OSA, 1997
- ▲ Fellow, OSA
- ▲ Member, USSR Academy of Sciences
- ▲ USSR State Prize for the discovery of optical phase conjugation, 1983

EMERITUS FACULTY**Larry C. Andrews**

Emeritus Professor of Mathematics, Optics and Photonics

Ph.D., Engineering, Michigan State University, 1970

Larry.andrews@ucf.edu

Research

Propagation of laser beams through random media laser communication and laser radar

Other Experience

- ▲ Staff Mathematician, Antisubmarine Warfare Operation, Magnavox Co., Fort Wayne, IN
- ▲ Assistant Professor of Mathematics and Mechanics, Tri-State University, Angola, IN

Professional Activities

- ▲ Author of many textbooks and monographs on wave propagation through random media, applications to laser communications and radar, atmospheric optics, and advanced applied mathematics.

Honors and Awards

- ▲ Fellow, SPIE

**Michael Bass**

Emeritus Professor of Optics and Photonics, Physics, ECE

Ph.D., Physics, University of Michigan, 1964

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Research

Display technologies; all-optical 2- and 3-dimensional displays, up-conversion processes in dielectric materials, laser systems development, solid state laser design, models for high-average power solid state lasers, pump requirements, performance potentials and Limitations, spray cooling of diode laser bars, thermal management of diode laser arrays sources for solid state lasers

Other Experience

- ▲ Senior Research Scientist, Raytheon, 1966-73
- ▲ Director, Center for Laser Studies, USC, 1977-84
- ▲ Chair, EE Electrophysics, USC, 1984-87
- ▲ Vice President for Research, UCF, 1988-93
- ▲ Professional Activities
- ▲ Associate Editor, Optics Express
- ▲ Editor-in-chief "Handbook of Optics, 2nd and 3rd editions, OSA
- ▲ Associate Editor, 100th Anniversary of OSA commemorative books

Honors and Awards

- ▲ R. W. Wood Prize 2014
- ▲ Fellow, OSA, IEEE
- ▲ Fellow of LIA
- ▲ Fellow of AAAS
- ▲ Fellow of Russian Academy of Engineering Science
- ▲ Fellow of National Academy of Inventors

**Glenn D. Boreman**

Emeritus Professor of Optics and Photonics, Professor and Chair Univ. North Carolina

Ph.D., Optical Sciences, University of Arizona, 1984

gboreman@uncc.edu

Research

Infrared antennas and transmission lines, infrared frequency-selective surfaces, nano-scale E-field mapping, BRDF & surface-scatter measurement.

Other Experience

- ▲ Visiting Scholar, Imperial College (London), ETH (Zurich), Defense Research Agency (FOI) Sweden, Univer. Complutense (Madrid).
- ▲ Consultant, Licensed Professional Engineer

Professional Activities

- ▲ Editor-in-Chief, Applied Optics
- ▲ Co-author, *Infrared Detectors & Systems*
- ▲ Author, *Basic Electro-Optics for EEs & Modulation Transfer Function in Optical and Electro-Optical systems*
- ▲ 2015 SPIE Vice President
- ▲ Co-founder, Plasmonics, inc.

Honors and Award

- ▲ Fellow, OSA, SPIE
- ▲ SPIE Kingslake Medal
- ▲ Fellow, Military Sensing Symposium

**Ronald L. Phillips**

Emeritus Professor of EECS, Optics and Photonics

Ph.D., Electrical Engineering, Arizona State University, 1971

Ronald.phillips@ucf.edu

Research

Laser space communication systems, laser radar, detection theory and math modeling, optical wave propagation through random media, random field theory

Other Experience

- ▲ Academic positions at Arizona State University and the University of California, San Diego.

Professional Activities

- ▲ Founding Director, UCF Florida Space Institute (FSI)
- ▲ Founding Director of CREOL
- ▲ Author of 3 books in the topic of wave propagation through random media and applications to laser communications and radar.
- ▲ Co-author of a text on advanced applied mathematics.

Honors and Awards

- ▲ Senior NATO Post-doctoral Fellow
- ▲ ASEE 1983 Medal Outstanding Contributions to Research
- ▲ Florida Space Business Roundtable Explorer Award for education
- ▲ Fellow, OSA, SPIE

**William Silfvast**

Emeritus Professor of Optics and Photonics

Ph.D., Physics, University of Utah, 1965

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Research

X-Ray science and technology, EUV lithography and microscopy, X-Ray theory, X-Ray Lasers.

Other Experience

- ▲ Chair, UCF Department of Physics, 1994-97
- ▲ Distinguished Member Technical Staff, ATT-Bell Labs, 1994-97

Professional Activities

- ▲ Co-Chair, CLEO, 1983
- ▲ OSA Board of Directors, 1986-00
- ▲ Program Committee Member, LEOS, 1994-00
- ▲ Author, Textbook: "Laser Fundamentals," Cambridge University Press

Honors and Awards

- ▲ Fellow, OSA, APS, IEEE
- ▲ Guggenheim Fellow, Stanford University
- ▲ Distinguished Member Technical Staff, ATT-Bell Labs, 1983
- ▲ NATO Postdoctoral Fellow
- ▲ Researcher of the Year, University of Central Florida, 2000

JOINT FACULTY

**Matthieu Baudelet**

Assistant Professor of Chemistry, National Center for Forensic Science

Ph.D., Physics, Université Claude Bernard Lyon 1, France

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**Debashis Chanda**

Assistant Professor, AMPAC/NSTC

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**Michael Chini**

Assistant Professor, Physics

Ph.D., University of Central Florida

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Professor and University Chair in Mechanical Engineering

Ph.D., University of California, Berkeley

Heat Transfer Issues in Electro-Optics

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**Yajie Dong**

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Ph.D., Harvard University

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**Andre Gesquiere**

Associate Professor, Nanoscience Technology Center, Chemistry

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D.Sc., Universidad Central de Venezuela & Université
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David Kaup

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Michael Leuenberger

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Arkadiy Lyakh

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Robert E. Peale

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Seetha Raghavan

Associate Professor of MAE
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Optical Characterization of Advanced Materials
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Alfons Schulte

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Dr. rer. Nat, Technical University of Munich
Near-IR Raman Spectroscopy
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Mubarak A. Shah

Agere Chair Professor of Computer Science
Ph.D., Wayne State University
Computer Vision
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Michael Sigman

Professor of Chemistry
Ph.D., Florida State University
Explosives, Chemistry & Forensics
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Jayan Thomas

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Ph.D., Cochin University of Science & Technology
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Subith Vasu

Assistant Professor, Mechanical and Aerospace
Engineering
Ph.D., Stanford University
Mechanical Engineering
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Dr. Glebov (L), Dr. Van Stryland (C) as Dr. Richardson explains research at the
Open House for the Optical Materials Laboratory, March 2017.

COURTESY FACULTY



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Jason Eichenholz

Divisional Technology Director, Halma CEO,
Open Photonics, Inc.
Ph.D., CREOL, University of Central Florida
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James E. Harvey

Associate Professor of Optics and Photonics &
ECE
Ph.D., Optical Sciences, University of Arizona, 1976
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Hans P. Jenssen

AC Materials
Ph.D., MIT
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Vassilios Kovanis

AFRL, Sensors Directorate
Ph.D., University of New Mexico
Semiconductor lasers, nonlinear optics
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Ilya Mingareev

Assistant Professor, Florida Institute of
Technology
Ph.D., RWTH Aachen University
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Clara Rivero Baleine

Mechanical Engineer Staff, Lockheed Martin
Missiles and Fire Control
Ph.D., CREOL/Optics and Photonics, University of
Central Florida
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Jannick Rolland

Brian J. Thompson Professor of Optical Engi-
neering, Professor of Biomedical Engineering,
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Emil Wolf

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ADJUNCT FACULTY



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Umar Piracha

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Electrical Engineering
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2017 FACULTY AWARDS AND HONORS

NATIONAL AND INTERNATIONAL AWARDS

Fellow of The Optical Society	Sasan Fathpour
George W. Morey Award, American Ceramic Society	Kathleen Richardson
Member of the National Academy of Inventors	Aravinda Kar
Sir Richard Brook International Award, European Ceramic Society	Kathleen Richardson

UNIVERSITY AWARDS

Pegasus Professor Award	David Hagan
Teaching Incentive Program Award (College Level)	Mercedeh Khajavikhan
Research Incentive Award (College Level)	Sasan Fathpour
Excellence in Undergraduate Teaching Award (College level)	Sasan Fathpour
Excellence in Graduate Teaching Award (College level)	Axel Schülzgen
Excellence in Research Award (College level)	Kathleen Richardson
Reach for the Stars Award	Mercedeh Khajavikhan
UCF Chapter of NAI	Dennis Deppe
UCF Chapter of NAI	Winston Schoenfeld
UCF Chapter of NAI	William Silfvast

HISTORICAL FACULTY AWARDS AND HONORS



1997 Max Born Award	Boris Zeldovich
1999 Nicholas Holonyak Award	Dennis Deppe
1999 Esther Hoffman Beller Award	Bahaa Saleh
2008 Esther Hoffman Beller Award	M.J. Soileau
2008 Distinguished Service Award	Bahaa Saleh
2010 Joseph Fraunhofer/Robert M. Burley Prize	Shin-Tson Wu
2003 R. W. Wood Prize	George Stegeman (in memoriam)
2011 R. W. Wood Prize	Demetrios Christodoulides
2012 R. W. Wood Prize	Eric Van Stryland
2013 C.E.K. Mees Medal	Bahaa Saleh
2014 R. W. Wood Prize	Michael Bass



1995 Kingslake Medal and Prize	Glenn Boreman
2004 Bacus Award	Bahaa Saleh
2008 Dennis Gabor Award	Leonid Glebov
2008 G. G. Stokes Award	Shin-Tson Wu
2008 Gold Medal Award	M.J. Soileau
2013 Harold E. Edgerton Award	Martin Richardson
2015 G.G. Stokes Award	Aristide Dogariu



2003 Engineering Achievement	Dennis Deppe
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2008 Jan Rajchman Prize	Shin-Tson Wu
2011 Slottow–Owaki Prize	Shin-Tson Wu



2011 Edward A. Bouchet Award	Peter Delfyett
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ACerS Outstanding Educator Award (2009)	Kathleen Richardson
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NSF Presidential Early Career Award (PECASE) (1997)	Peter Delfyett
NSF Presidential Young Investigator Award (1991)	Dennis Deppe
NSF Career Award (2012)	Sasan Fathpour
NSF CAREER Award (2007)	Pieter Kik
NSF CAREER Award (2008)	Stephen Kuebler
NSF CAREER Award (1996)	Guifang Li
NSF CAREER Award (2015)	Sasan Fathpour



ONR Young Investigator Award (1991)
ONR Young Investigator Award (1995)
ONR Young Investigator Award (2013)

Dennis Deppe
Guifang Li
Sasan Fathpour



Ralph E. Powe Junior Faculty Award (2009)

Ayman Abouraddy



Guggenheim Fellow (1984)

Bahaa Saleh

FELLOWS OF PROFESSIONAL SOCIETIES AND ACADEMIES



Ayman Abouraddy
Michael Bass
Zenghu Chang
Demetrios Christodoulides
Peter Delfyett
Dennis Deppe
Aristide Dogariu
Ronald Driggers

Sasan Fathpour
Leonid Glebov
David Hagan
Guifang Li
Jim Moharam
James Pearson
Kathleen Richardson
Martin Richardson

Bahaa Saleh
William Silfvast
M.J. Soileau
George Stegeman (in memoriam)
Eric Van Stryland
Konstantin Vodopyanov
Shin-Tson Wu
Boris Zeldovich



Glenn Boreman
Peter Delfyett
Ronald Driggers
Leonid Glebov
David Hagan
James Harvey

Guifang Li
James Pearson
Kathleen Richardson
Martin Richardson
Bahaa Saleh

Winston V. Schoenfeld
M.J. Soileau
Eric Van Stryland
Konstantin Vodopyanov
Shin-Tson Wu



Michael Bass
Peter Delfyett
Dennis Deppe
Guifang Li

Martin Richardson
Bahaa Saleh
William Silfvast

M.J. Soileau
Eric Van Stryland
Shin-Tson Wu



Zenghu Chang
Aristide Dogariu
Demetrios Christodoulides
Peter Delfyett

Martin Richardson
Bahaa Saleh
Eric Van Stryland
Konstantin Vodopyanov



Aravinda Kar
Michael Bass



Leonid Glebov
Kathleen Richardson



Shin-Tson Wu



Michael Bass
Martin Richardson



Michael Bass
Peter Delfyett
Leonid Glebov

Aravinda Kar
Guifang Li

M.J. Soileau
Shin-Tson Wu



M.J. Soileau
Shin-Tson Wu

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	Eric Van Stryland Michael Bass Peter Delfyett Bahaa Saleh Eric Van Stryland Shin-Tson Wu	President (2006) Board of Directors Member (1989–1992) Board of Directors Member (2004–2006) Board of Directors Member (1998–2005) Board of Directors Member (1998–2001) Board of Directors Member (2013–2014)
	M.J. Soileau Glenn Boreman James Harvey Kathleen Richardson	President (1997) Board of Directors Member (1997–1999) Board of Directors Member (2001–2003) Board of Directors Member (2012–2015)
	Shin-Tson Wu Peter Delfyett Jim Moharam Kathleen Richardson	Board of Govenors (2003–present) Board of Govenors (2000–2002) Vice-President (1997–1999) Board of Directors Member (2012–2015)
	Michael Bass Michael Bass Aravinda Kar Bahaa Saleh Eric Van Stryland	President (1988) Board of Directors Member (1985–1989) Board of Directors Member (2005) Board of Directors Member (2010–2012) Board of Directors Member (1992–1994)
	Peter Delfyett	President (2008–2011)
	Kathleen Richardson Kathleen Richardson	Board of Directors Member (2008–2015) President (2014–2015)
	Peter Delfyett	Vice-Chair (2015–Present)
	Kathleen Richardson	President (2008–2009)

Second Annual Gala for the UCF Chapter of NAI - November 30, 2017

At the University of Central Florida, we celebrate innovation. We recognize that the discoveries made in our labs today will be the breakthrough solutions of tomorrow. To honor the men and women that are pursuing and sharing these discoveries, we opened a local chapter of the National Academy of Inventors. Through this chapter we will also celebrate the leadership who foster and nurture innovation at UCF and within our local community. The 2017 CREOL Inductees are:

- ▲ Dennis Deppe
- ▲ Sangyoun Gee, Alum Ph.D. 2000
- ▲ Winston Schoenfeld
- ▲ William Silfvast



INTERNATIONAL AWARDS AND HONORS

Michael Bass	Fellow, Russian Academy of Engineering Science (1994)
Michael Bass	Fellow, International Academy of Engineering, Russia
Michael Bass	Fellow, American Association for the Advancement of Science (2016)
Zenghu Chang	Hubert Schardin Gold Medal Medal (1996)
Kathleen Richardson	I.D. Varshnei Award, Indian Ceramic Society (2013)
Martin Richardson	Hubert Schardin Gold Medal Medal (1976)
Martin Richardson	Honorary doctorate, University of Bordeaux, France (2013)
Bahaa Saleh	Kuwait Prize (2006)
Axel Schülzgen	Habilitation Grant, German Research Foundation (1993)
Axel Schülzgen	Carl-Ramsauer-Award of the AEG AG (1992)
M.J. Soileau	ICFO's Distinguished Service Appreciation Medal (2012)
M.J. Soileau	Foreign Member of the Russian Academy of Sciences (2016)
George Stegeman	Honorary doctorate, NRS University, Canada (2013)
Boris Zeldovich	USSR Academy of Sciences (1987)
Boris Zeldovich	USSR State Prize (1983)

JOURNAL EDITORS

Journal of the Optical Society of America B (1984–1987)	Michael Bass
Applied Optics (2000–2005)	Glenn Boreman
Applied Optics/Optical Technology (1998–2003)	Glenn Boreman
Applied Optics/Optical Technology (2004–2010)	Aristide Dogariu
IEEE Journal of Selected Topics in Quantum Electronics (2001–2006)	Peter Delfyett
IEEE/LEOS Newsletter (1995–2000)	Peter Delfyett
Applied Optics (2015–present)	Ronald Driggers
Optical Engineering (2012–2015)	Ronald Driggers
Optics Communications (2011–2012)	Pieter Kik
Optical Materials Express (2010–present)	David Hagan
Chinese Optics Letters (2016)	David Hagan
Journal of the Optical Society of America A (1991–1997)	Bahaa Saleh
Advances in Optics & Photonics (2008–2014)	Bahaa Saleh
IEEE/OSA Journal of Display Technology (2004–2008)	Shin-Tson Wu

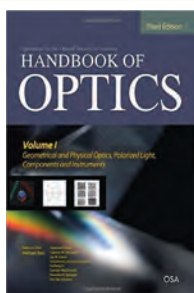
ASSOCIATE AND TOPICAL EDITORS

Optica (2014– present)	Konstantin Vodopyanov
Optics Express (2001–2001)	Michael Bass
Optical Engineering (Radiometry & Detectors) (1998–1999)	Glenn Boreman
Applied Optics (Radiometry & Detectors) (1992–1997)	Glenn Boreman
Optics Express (2009–present)	Glenn Boreman
International Journal of Optics (2008–present)	Glenn Boreman
IEEE Photonics Technology Letters (1995–2003)	Peter Delfyett
IEEE J. of Quantum Electronics (1996–2001)	Demetrios Christodoulides
Journal of the Optical Society of America B (2001–2003)	Demetrios Christodoulides
Journal of the Optical Society of America B (2007–2013)	David Hagan
Journal of Materials Research (2000–2007)	David Hagan
Journal of Experimental Nanoscience (2008–present)	Stephen Kuebler
Journal of Micro/Nanolithography, MEMS, & MOEMS (2008–present)	Stephen Kuebler
Optics Express (2007–present)	Guifang Li
Photonics Technology Letters (2007–present)	Guifang Li
Journal of the Optical Society of America A (1998–2004)	Jim Moharam
International Journal of Applied Glass Science (2009–present)	Kathleen Richardson
Optical Materials Express (September 2013)	Kathleen Richardson
Journal of Quantum Electronics (1980–1986)	Martin Richardson
Journal of the Optical Society of America A (1984–1990)	Bahaa Saleh
Journal of the Optical Society of America (1980–1983)	Bahaa Saleh
Journal of Materials Research (2007–present)	Winston Schoenfeld
Journal of the Optical Society of America B (2016–2017)	Axel Schülzgen
Applied Optics (2008–present)	Axel Schülzgen
IEEE Journal of Quantum Electronics Lawrence Shah	Lawrence Shah
Optics Letters: Nonlinear Optics (1995–1998)	Eric Van Stryland
Reviews of Scientific Instruments (1978–1981)	Eric Van Stryland
IEEE/OSA Journal of Display Technology (2008–present)	Shin-Tson Wu
Liquid Crystals (2009–present)	Shin-Tson Wu

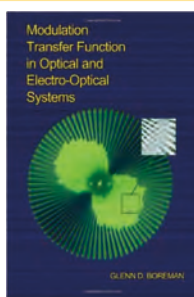
BOOKS



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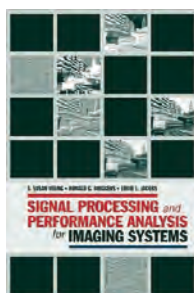
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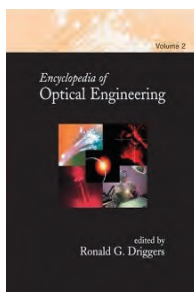
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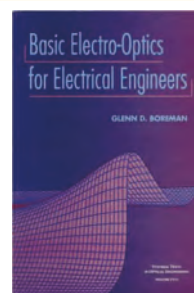
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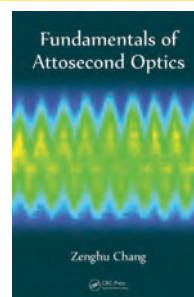
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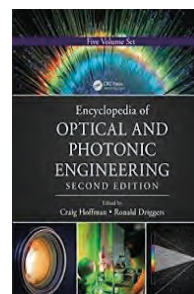
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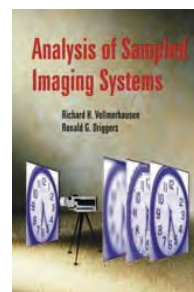
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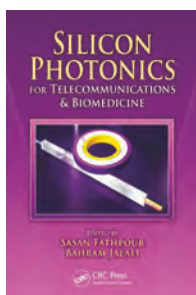
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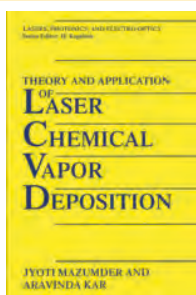
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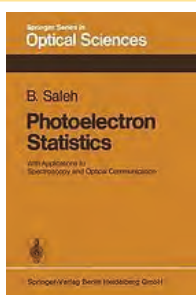
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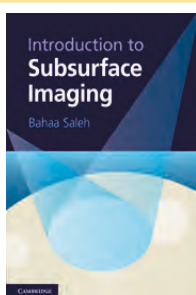
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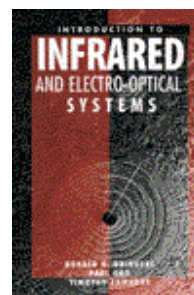
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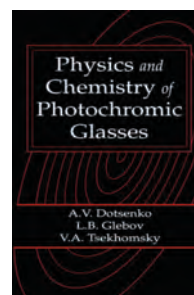
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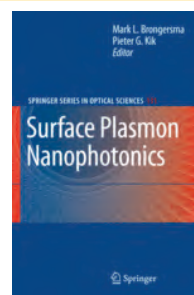
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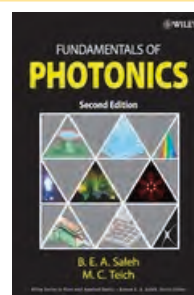
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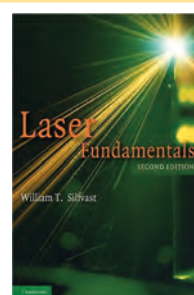
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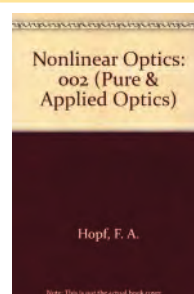
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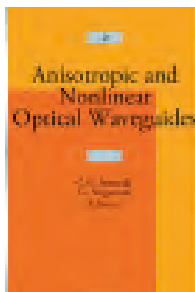
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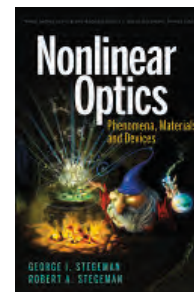


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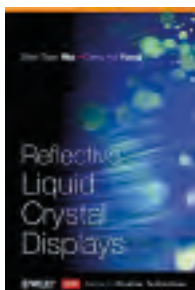
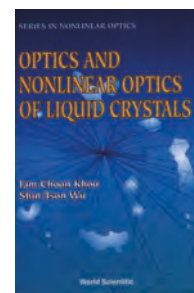
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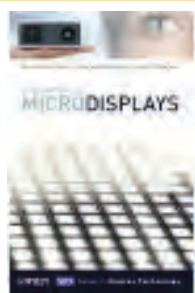
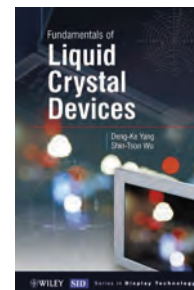
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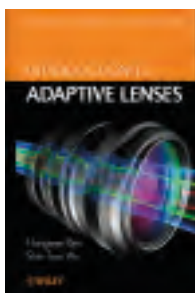
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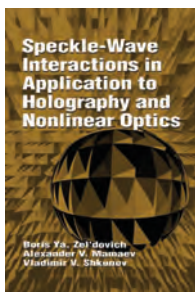
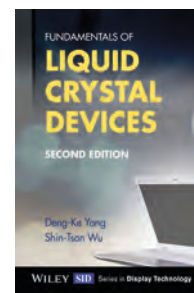
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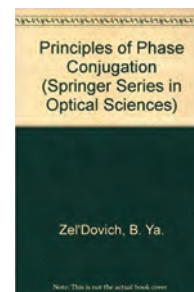
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and Vladimir V. Shkunov,
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Vladimir V. Shkunov
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Myungkoo Kang (Prof. K. Richardson)
Saeed Khan (Prof. Fathpour)
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VISITING RESEARCH SCIENTISTS

Mohammed Al-Mumin (Prof. Li)
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Gisela Lopez Galmiche (Prof. Christodoulides)
Reza Safian (Prof. Fathpour)
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He Wen (Prof. Li)
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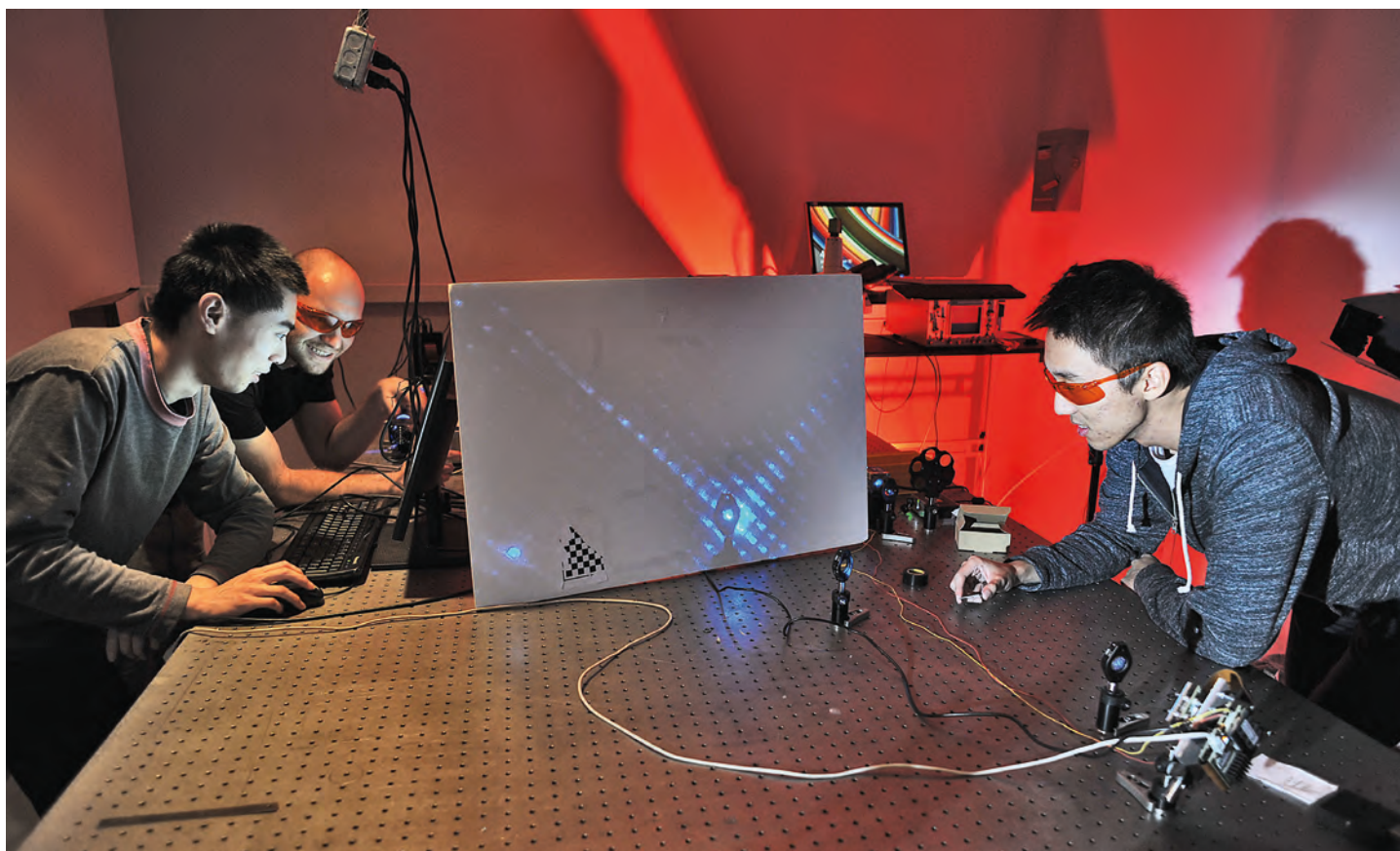
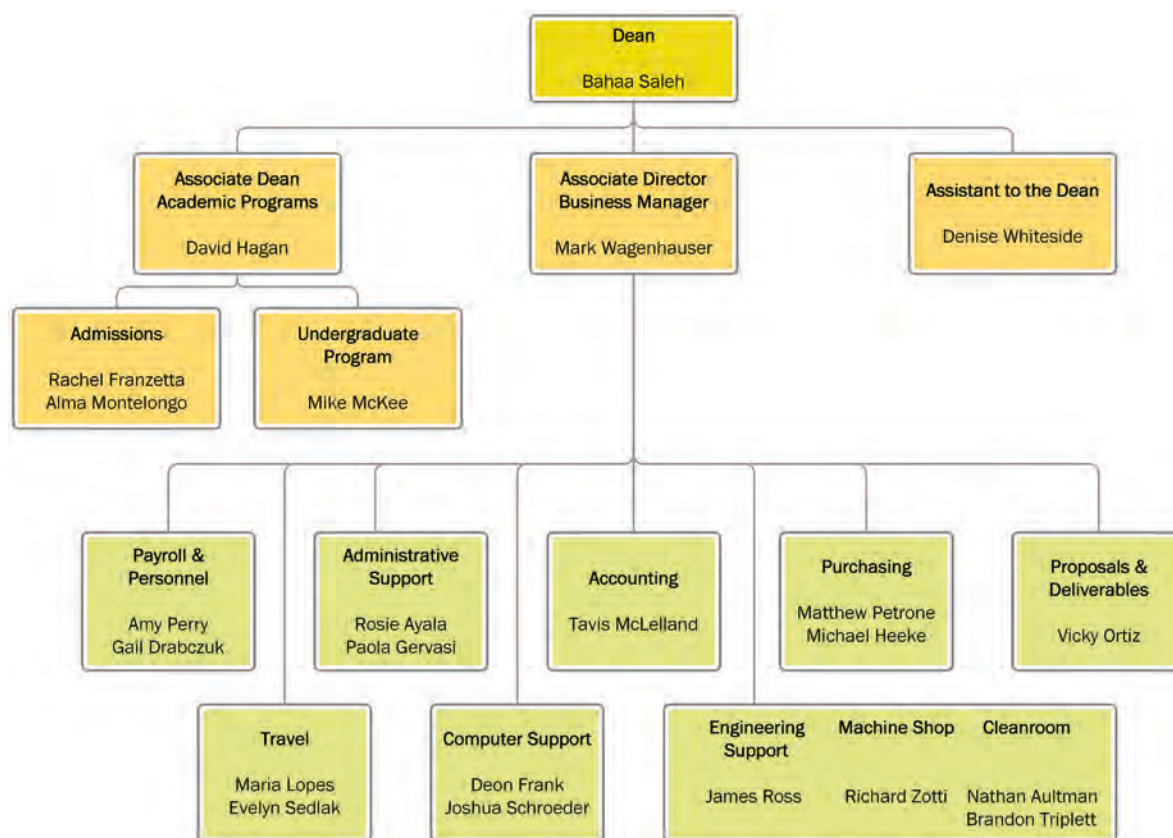


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rzotti@creol.ucf.edu

ORGANIZATIONAL CHART



Graduate students Zheyuan Zhu (l), Ryan Ellis (c) and He Cheng (r) in Dr. Sean Pang's Optical Imaging Systems Laboratory.

ACADEMIC PROGRAMS



In 2017, the undergraduate Photonics program reached a major milestone by being accredited by ABET. It is a great credit to the faculty and to program staff that the ABET evaluation team found absolutely no weaknesses in our program, only strengths, which is quite unusual for a first-time ABET accreditation. The undergraduate program committee, along with the faculty teaching in the program, have been extraordinarily engaged in the development of the program, and have been highly responsive to the changes needed as the program has grown. At the graduate level, after a few years of reduced enrollment, the number of PhD students has started to rise again, in response to the recent growth in both new faculty hires and in external research funding. We anticipate this growth to continue slowly over the next few years.

UNDERGRADUATE PROGRAM

The College was notified in August that it had received accreditation from ABET for the Bachelor of Science in Photonic Science and Engineering, marking a major milestone in the history of the program. Accreditation extends from October 1, 2014 to September 30, 2021.

The ABET Accreditation team visited CREOL in September 2016 to evaluate the courses, faculty and program administration. In their review, they reported no weaknesses or concerns, citing only strengths. The self study report, submitted to ABET in July prior to their visit, was used as an exemplar for their summer workshop in July 2017.

Since the inception of the program in Fall 2013, the college has graduated 26 students. At the start of Fall 2017, there were 106 students enrolled in the program.

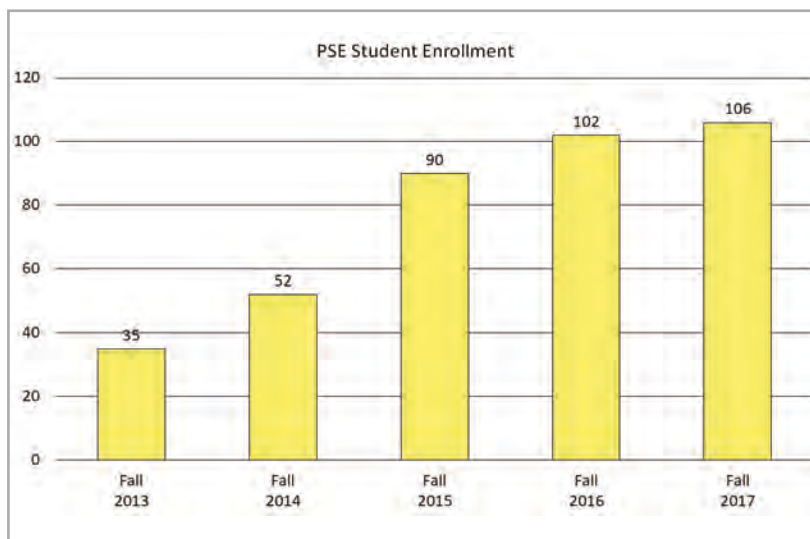
The PSE degree is offered as a joint program between the College of Engineering and Computer Science (CECS) and the College of Optics and Photonics (COP), making it the only B.S. in the state of Florida in this area and one of only a few in the nation.

The program is designed to fill the growing need for photonics engineers. Florida is home to about 270 photonics-based companies with an annual need of 270 photonics engineers. Nationally, there is a need to fill 3000 open positions. On a recent sampling of job postings, annual salaries begin at \$50,000 to \$70,000. Students who complete the program will be prepared for immediate employment or can pursue an advanced degree in optics and photonics. The U.S. Department of Labor is forecasting a need for approximately 30,000 new photonics engineers by 2024.

Students who enroll in this program are required to complete 128 credit hours of instruction with 28 credit hours from coursework in electrical engineering and 43 credit hours in optics and photonics. Coursework includes classes such as Electrical Networks, Electronics, Laser Engineering, Fiber Optic Communication, Biophotonics, and Imaging and Displays.

An undergraduate curriculum committee comprised of faculty and administrative staff within the college meets on a monthly basis to evaluate coursework.

Advising, recruiting, and orientations are conducted by Mike McKee, associate director for the undergraduate program. He has worked with major recruitment and retention units across the



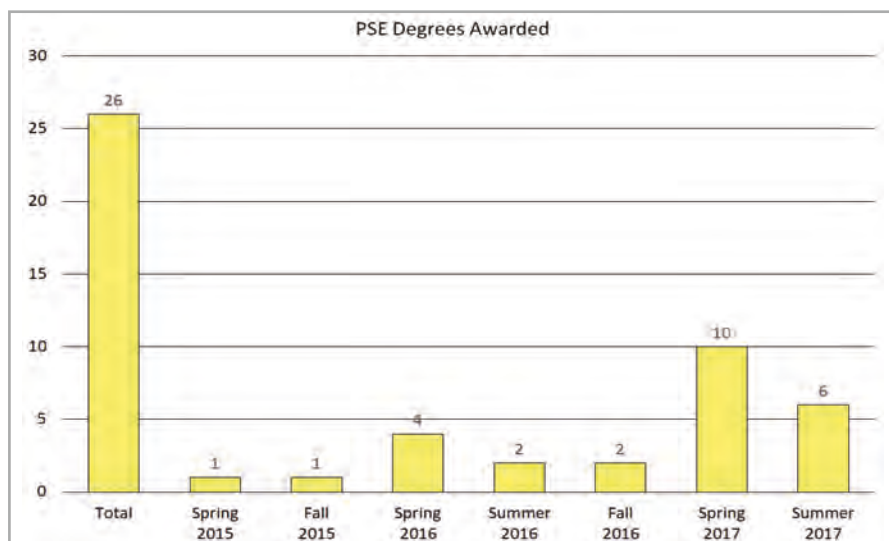
university including Undergraduate Admissions, First Year Advising, and the various colleges.

In the first several semesters of the PSE program, students enroll in electrical engineering coursework. The Department of Electrical Engineering decided to eliminate three classes which they deemed no longer relevant: Engineering Statics, Engineering Dynamics and Thermofluids. Since the PSE program is closely aligned to their program, these classes were also eliminated from the PSE program of study.

Undergraduate Labs

Two undergraduate lab facilities are available to students. The Undergraduate Lab is a shared space where all course-based labs (for example, Optoelectronics and Laser Engineering) are conducted. A second lab facility opened in Fall 2016 which hosts students who are working on Senior Design projects. This space has six lab benches and are outfitted with basic electronic and photonic meters and

instruments and is available to students enrolled in Senior Design twenty-four hours a day, seven days a week.



GRADUATE PROGRAM

GRADUATE RECRUITMENT AND ENROLLMENT

Enrollment in the PhD program in Fall 2017 at 111 represents an increase over the previous six years. This is primarily due to the hiring of new faculty, along with increase in external funding for the prior year. As new faculty increase their research funding portfolios, we expect the PhD enrollment to grow over the next 5 years.

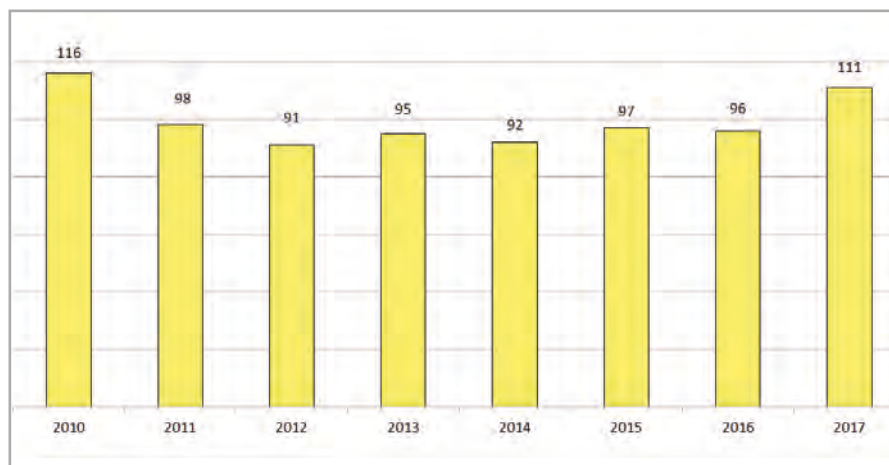
The average MS enrollment has remained roughly constant over the past five years. New initiatives for future years, including the offering of Photonics courses at Lockheed-Martin, are expected to grow enrollement in the MS program.

A combined total of 24 new students (23 Ph.D. and 1 MS) enrolled in Fall 2017. The following tables reflect the enrollment recorded at the beginning of the fall semester in each academic year, (This number fluctuates slightly throughout the year due to students entering and graduating in different terms.) Note that we have corrected the way in which we report the number of MS students compared to previous annual reports, so as to count students who are active in both M.S. and Ph.D programs only once.

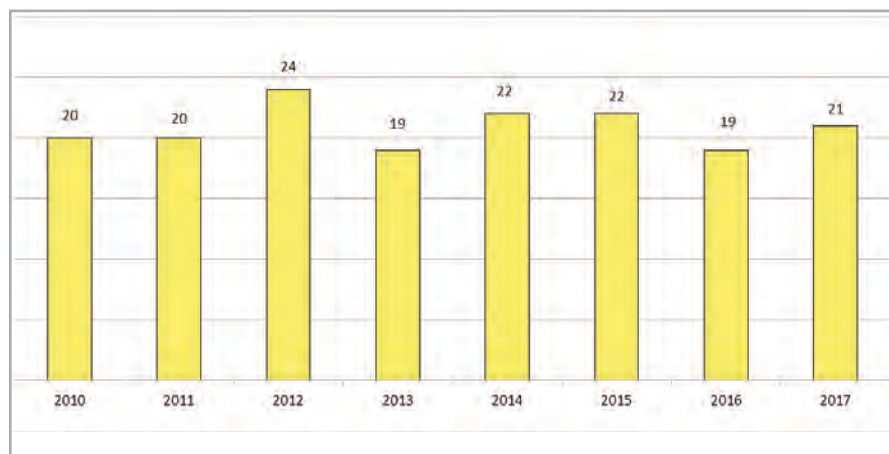
Overall, we received 252 pre-applications and 185 full applications to the graduate programs for Fall 2017. The pre-application is a preselection tool operated on the college web site that allows us to make contact with applicants early and to help advise international students as to whether to apply officially, which is an expensive undertaking for many international students.

The mean GRE perecentile scores for admitted students of 84% for Fall 2017 is equal to the five year average of 84% for the Quantitative Scores. The highest Mean Percentile Ranking achieved over the last five years was 86% in 2015.

Attracting a balance of gender is a target that CREOL is attempting to achieve. In fall 2017, 26.1% of PhD and 0% of MS students were female. Our goal is to grow the number of female



History of Ph.D. Enrollment since 2008



History of M.S. Enrollment since 2008

students admitted by 10% each year. The College maintains a strong focus on education at both undergraduate and graduate levels. Our M.S. and Ph.D. programs emphasize rigorous coursework and strong opportunities to conduct leading-edge research. Our goal is that when our M.S. and Ph.D. students graduate, they are well prepared to become leaders in the field of optics and photonics, whether they choose a career in industry or academia.

Fall 2017 Mean GRE Scores										
		Quantitative		%	Verbal	%	Analytic Writing		%	
Ph.D.	US	159.2		73%	155.5	65%	4.3		74%	
	Intl	165.2		86%	149.4	45%	3.1		25%	
M.S.	US									
	Intl	170.0		97%	148.0	38%	3.0		17%	

New Matriculant Demographic						Fellowships & Scholarships				
		Male	Female	FT	PT	ORC Fellowship	CREOL Fellowship	Endowed Fellowship Award	UCF Trustee	UCF Dean
Ph.D.	US	3	3	6	0	5	1	0	0	0
	Intl	14	3	17	0	16	1	0	0	0
M.S.	US	0	0	0	0	0	0	0	0	0
	Intl	1	0	1	0	0	0	0	0	0
Total New Students			24							

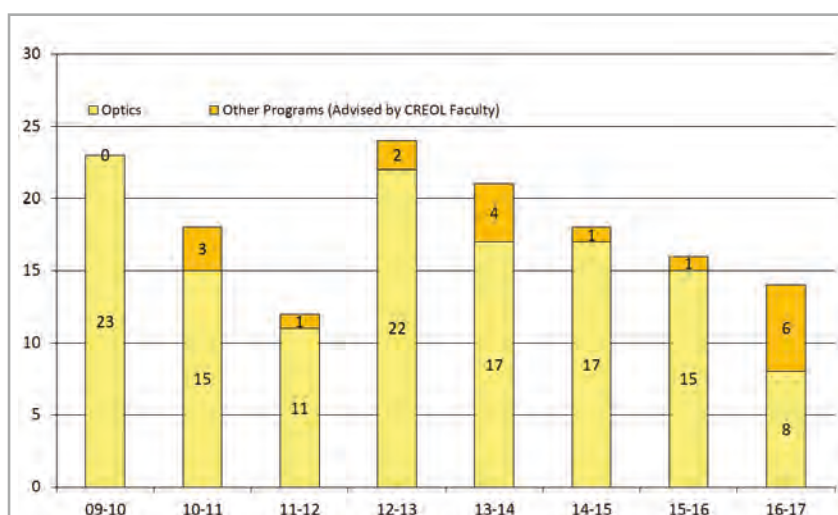
* Northrop Grumman, Schwartz, Suchoski, Frances Townes

DEGREES AWARDED

The charts on the right display the number of graduate degrees awarded in each academic year of the last decade. As shown in the chart below, there was a small drop in the number of PhD degrees awarded in the past year. A total of 77 degrees were awarded between 2007 to 2016, and the average awarded is 15.4 per year.

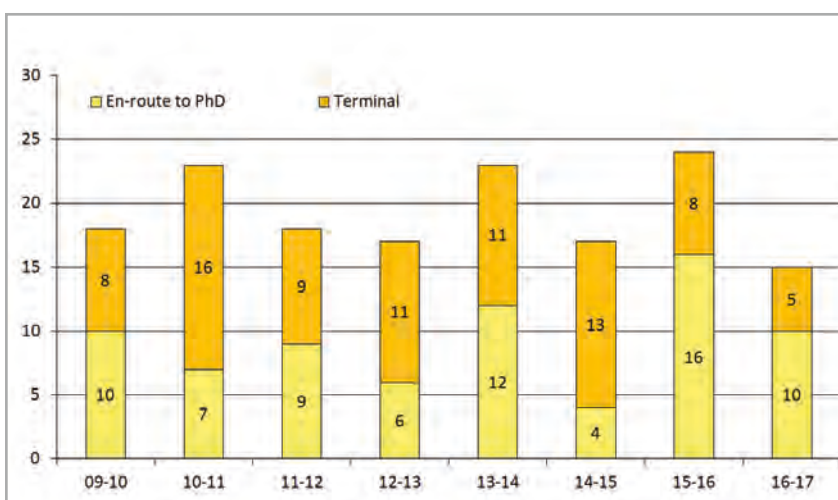
The average number of degrees awarded over the period from 2007 to 2016 is 21 per year. Although the number of graduates in 2016-17 is slightly lower than this, we attribute this only to statistical fluctuation.

Note that we have changed the definition of “academic year” as compared to previous years to match the way UCF records data. The UCF academic year begins in the summer term.



Top: PhD degrees awarded to students in the College of Optics and Photonics and students in other UCF colleges with College of Optics and Photonics advisors.

Bottom: MS degrees awarded. Recipients of these degrees are classified into two groups: those who leave with an MS degree (“Terminal MS”) and those who are continuing on to the PhD degree (“En-route to PhD”).



COURSES TAUGHT

COURSE NUMBER AND NAME		SPRING 2017	SUMMER 2017	FALL 2017
CORE GRADUATE COURSES				
OSE 5115	Interference, Diffraction and Coherence	Abouraddy		Kar
OSE 5414	Fundamentals of Optoelectronics			Gelfand
OSE 5203	Geometrical Optics and Imaging Systems			Moharam
OSE 5312	Light Matter Interaction	Gaume		Kik
OSE 6111	Optical Wave Propagation	Argenti		Moharam
OSE 6211	Imaging and Optical Systems	Zeldovich		Saleh
OSE 6265	Optical Systems Design		Curatu	
OSE 6421	Integrated Photonics	Fathpour		
OSE 6474	Optical Communication Systems	Christodoulides		
OSE 6525	Laser Engineering	Schülzgen		Khajavikhan
OTHER GRADUATE COURSES				
OSE 6120	Theoretical Foundations of Optics			Zeldovich
OSE 6125	Computational Photonics	Moharam		
OSE 6334	Nonlinear optics	Van Stryland		
OSE 6335	Nonlinear Guided Wave Optics			Christodoulides
OSE 6349	Applied Quantum Mechanics for Optics			Kik
OSE 6445	Fundamentals of Ultrafast Optics			Delfyett
OSE 6447	Attosecond Optics			Chang
OSE 6455C	Photonics Laboratory			Yu
OSE 6526C	Laser Engineering Laboratory	Vodopyanov	Richardson	
OSE 6615L	Optoelectronic Device Fabrication Laboratory	Chanda		Chanda
OSE 6650	Optical Properties of Nanostructured Materials	Kik		
OSE 6820	Flat Panel Displays		Wu	
OSE 6938	ST: Modern Methods of Optical Spectroscopy	Gelfand		
OSE 6938	ST: Terahertz Technologies & Applications		Vodopyanov	
OSE 6938	ST: Semiclassical Laser Theory			Van Stryland
UNDERGRADUATE COURSES				
OSE 3052	Introduction to Photonics	Amezcu		LiKamWa
OSE 3052L	Introduction to Photonics Laboratory	Divliansky		Divliansky
OSE 3053	Electromagnetic Waves for Photonics	Moharam		
OSE 3200	Geometric Optics	Renshaw		Renshaw
OSE 4240	Optics and Photonics Design	Curatu		
OSE 4410	Optoelectronics	Khajavikhan		
OSE 4410L	Optoelectronics Laboratory	Kar		
OSE 4470	Fiber-Optic Communications			Amezcu
OSE 4470L	Fiber-Optic Communications Laboratory			Li
OSE 4520	Laser Engineering	Delfyett		
OSE 4520L	Laser Engineering Laboratory	LiKamWa		
OSE 4720	Visual Optics	Saleh		
OSE 4721	Biophotonics			Han
OSE 4830	Imaging and Display			Pang
OSE 4830L	Imaging and Display Laboratory			Vodopyanov
OSE 4930	Frontiers of Optics and Photonics			Kuebler
OSE 4951	Senior Design I	Hagan	Hagan	Hagan
OSE 4952	Senior Design II	Hagan	Hagan	Hagan
UNDERGRADUATE COURSES AT OTHER COLLEGES				
EEL 4440	Optical Engineering			LiKamWa
EGN 3365	Structure and Property of Materials			Gaume
PHY 3220	Mechanics I			Argenti

DOCTORAL DISSERTATIONS

Degrees granted in academic year Summer 2016 – Spring 2017

STUDENT	PROGRAM	ADVISOR	DISSERTATION TITLE
Jeffrey Chiles	Optics & Photonics	Sasan Fathpour	Hybrid Integrated Photonic Platforms and Devices
Seyed Hossein Hodaieiesfahani	Optics & Photonics	Mercedeh Khajavikhan	Novel Photonic Resonance Arrangements Using Non-Hermitian Exceptional Points
Mingxin Li	Optics & Photonics	Dennis Deppe	Intrinsic Modulation Response Modeling and Analysis for Lithographic Vertical-Cavity Surface-Emitting Lasers
Fenglin Peng	Optics & Photonics	Shin-Tson Wu	High Performance Liquid Crystals for Displays and Spatial Light Modulators
Amy Van Newkirk	Optics & Photonics	Axel Schülzgen	Sensing Using Specialty Optical Fibers
Tiansi Wang	Optics & Photonics	Aravinda Kar	Enhancement of Bandwidth and Laser Deflection Angle of Acousto-optic Deflectors by Dynamic Two-dimensional Refractive Index Modulation
Xu Yang	Optics & Photonics	Dennis Deppe	Electrical Parasitic Bandwidth Limitations of Oxide-Free Lithographic VCSELs
Peng Zhao	Optics & Photonics	David Hagan / Eric Van Stryland	Ultrafast Mechanisms for Nonlinear Refraction and Two-Photon Photochromism
Haider Ali	Material Science	Winston Schoenfeld	Study of Surface Passivation Behavior of Crystalline Silicon Solar Cells
Antoine Lepicard	Material Science	Kathleen Richardson	Design Of Surface Chemical Reactivity And Optical Properties In Glasses
Taylor Shoulders	Material Science	Romain Gaume	Stress-induced phase change sintering: a novel approach to the fabrication of barium chloride transparent ceramic scintillators
Ahmed El Halawany	Physics	Demetrios Christodoulides	Optical Parity Time Metasurface Structures
Roxana Rezvani Naraghi	Physics	Aristide Dogariu	Mesoscopic Interactions in Complex Photonic Media
Zeinab 'Zahoora' Sanjabi Eznaveh	Physics	Rodrigo Amezcua	High Power Fiber Lasers and Fiber Devices

MASTER'S THESES 2017

Y. Qin, *Design of a hydrogen-filled hollow-core fiber raman laser*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

W. Zhu, *Picosecond Yb-doped fiber amplifier*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

D. Zhang, *System for metal coated fiber fabrication*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

A. Todi, *High power continuous wave quantum cascade lasers with increased ridge width*,

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

Matthew Suttinger, *Thermal and waveguide optimization of broad area quantum cascade laser performance*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

H. Cheng, *Active computational imaging*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

H. Kerrigan, *Enhanced Ablation By Femtosecond and Nanosecond Laser Pulses*, A thesis

submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

J. Cook, *Photothermal lensing in mid-infrared materials*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

D. Thul, *Propagation of tailored filaments*, A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in CREOL, The College of Optics and Photonics at the University of Central Florida, Orlando (2017).

STUDENT SCHOLARSHIPS AND AWARDS

National

SCHOLARSHIPS AND FELLOWSHIPS

Haiwei Chen, 2017 SPIE Optics and Photonics Education Scholarship
Nick Kosan, Astronaut Scholarship
Michael Plascak, Directed Energy Professional Society (DEPS) Scholarship
Ali Jahromi, OSA 2017 Boris P. Stoicheff Memorial Scholarship
Haiwei Chen, IEEE Graduate Student Fellowship
Austin Singh, Northrop Grumman Scholarship

AWARDS

Haiwei Chen, IEEE Orlando Section Outstanding Graduate Student award
Haiwei Chen, IEEE Orlando Section Graduate Student award
Haiwei Chen, SPIE Newport Research Excellence Award
Zahoor Sanjabi Eznaveh-2nd place, Corning Outstanding Student Paper Competition
Ruidong Zhu, Haiwei Chen, Guanjun Tan, SID "Outstanding Student Paper of the Year Award"
Hossein Hodaie, SPIE Optics and Photonics Conference Best Student Paper
Bin Huang, runner up, ECOC 2017 Best Student Paper Award
Zhean Shen, Emil Wolf Outstanding Student Paper Award
Seth Smith-Dryden, Emil Wolf Outstanding Student Paper Award
Ali Jahromi, finalist, Emil Wolf Outstanding Student Paper Competition
Mahed Batarseh, finalist, Emil Wolf Outstanding Student Paper Competition
Eduardo Castillo-Orozco, First Place Poster Presentation Award, LIA & First Place Poster Presentation Award, (IMAPS), Florida Chapter
Hao Chen, JSID's Outstanding Student Paper Award

TRAVEL GRANTS

Haiwei Chen, Fenglin Peng, Guanjun Tan, Juan He, Yun-Han Lee, Fangwang Gou, Yuge Huang, Hao Chen, SID Student Travel Grant
Sepehr A Benis, Photonics West Student Travel Grant
Esat Kondakci, IEEE Photonics Conference (IPC) Student Travel Grant

UCF

UNDERGRADUATE

Marielena Burdge, UCF Founders' Award
Marielena Burdge, Service-Learning Student Showcase Scholarship

GRADUATE

Mohammad Amin Eftekhari- Research Forum Poster Award, First Place Doctoral, Math, Optics and Physical Sciences
Haiwei Chen, Graduate Presentation Fellowship
Sepehr A Benis, Graduate Presentation Fellowship
Rafaela Frota, Integrative Learning Scholarship
Fenglin Peng, Dean's Dissertation Completion Fellowship
Ryan Ellis, Integrative Learning Scholarship
Kevin Gaj, Integrative Learning Scholarship

College of Optics & Photonics Awards

Hossein Hodaie, 2017 Student of The Year Award
Fenglin Peng, finalist, 2017 Student of the Year Award
Roxana Rezvani Naraghi, finalist, 2017 Student of the Year Award
Alex Sincore, 2017 Best Poster Award

GRADUATE STUDENTS

Doctoral Students

STUDENT

Abdelsalam, Kamal
Ahmadzadeh Benis, Sepehr
Akhlaghi Bouzan, Milad
Ali, Haider
Alvarado Zacarias, Juan Carlos
Alvarez Aguirre, Roberto A.
Anderson, James
Bagnell, Kristina
Bakhshi, Sara
Batarseh, Mahed
Bayat, Mina
Bradford, Joshua
Bustos Ramirez, Ricardo
Butrimas, Steven
Camacho Gonzalez, Guillermo
Chen, Haiwei
Chen, Hao
Chew, Andrew
Chiles, Jeffrey
Cook, Justin
Cox, Nicholas
Croop, Benjamin
Eftekhar, M. Amin
El Halawany, Ahmed
Fan, Shengli
Gao, Munan
Gausmann, Stefan
Gemar, Heath
Gou, Fangwang
Guzman Sepulveda, J. Rafael
Hale, Evan
Haq, A F M Saniul
Ulhassan, Absar
Hayenga, William
He, Juan
He, Ziqian
Hodaieesfahani, S. Hossein
Hossain, Mohammad Jobayer
Hu, Shuyuan
Huang, Bin
Huang, Yuge
Kassel, Jennifer
Kawamori, Taiki
Kazemi Jahromi, Ali
Kerrigan, Haley
Khaw, Ian
Kompan, Fedor
Lam, Mach
Larson, Walker
Lee, Yun Han
Lepicard, Antoine
Li, Jinxin
Li, Mingxin
Li, Jie
Liu, Huiyuan
Lopez Aviles, Helena
Ma, Zhao
Malinowski, Marcin
Modak, Sushrut
Nicholas, Robert
Nye, Nicholas
Parto, Midya
Peng, Fenglin
Plascak, Michael
Rahaman, Arifur
Rao, Ashutosh
Ren, Jinhan
Rezvani Naraghi, Roxana
Roumayah, Patrick
Ru, Qitian
Sampson, Rachel
Sanchez Cristobal, Enrique
Sanjabi Eznavah, Zeinab
Shen, Zhean
Shin, Dong Jin
Short, Robert
Shoulders, Taylor
Sincore, Alex
Singh, Mamta
Sisken, Laura
Sjaardema, Tracy
Smith-Dryden, Seth

ADVISOR

Fathpour
Hagan/Van Stryland
Dogariu
Schoenfeld
Amezcu-Correa
Glebov
Schülzgen
Delfyett
Schoenfeld
Dogariu
Deppe
M. Richardson
Delfyett
Driggers
Fathpour
Wu
Dong
Chang
Fathpour
M. Richardson
Hagan/Van Stryland
Han
Christodoulides
Christodoulides
Li
Hagan/Van Stryland
Schülzgen
Dogariu
Wu
Dogariu
Glebov
Yuksel
Christodoulides
Khajavikhan
Wu
Wu
Khajavikhan
Driggers
Chang
Li
Wu
Renshaw
Vodopyanov
Abouraddy
Renshaw
Han
Glebov
Chang
Saleh
Wu
K. Richardson
Gelfand
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Li
Christodoulides
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Christodoulides
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Fathpour
Khajavikhan
Dogariu
M. Richardson
Vodopyanov
Li
Khajavikhan
Amezcu-Correa
Dogariu
M. Richardson
Driggers
Gaume
M. Richardson

K. Richardson
Fathpour
Saleh

Szilagy, John
Sun, Yangyang
Suttinger, Matthew
Talukder, Javed Rouf
Tan, Felix
Tan, Guanjun
Tang, Jialei
Thul, Daniel
Tofighi, Salimeh
Van Newkirk, Amy
Vazquez-Guardado, Abraham
Wang, Tiansi
Wang, Yang
Wang, Ning
Wittek, Steffen
Wu, Fan
Xu, Chi
Yang, Xu
Zhan, Tao
Zhang, Yuanhang
Zhao, Peng
Zhao, Jian
Zhu, Ruidong

M. Richardson
Pang
Lyakh
Vodopyanov
Abouraddy
Wu
Han
M. Richardson
Hagan/Van Stryland
Schülzgen
Chanda
Kar
Chang
Li
Amezcu-Correa
Christodoulides
LiKamWa
Deppe
Wu
Li
Hagan/Van Stryland
Schülzgen
Wu

Master's Students

STUDENT

Cheng, He
Dhasmana, Nitesh
Fisher, Chris
Go, Rowel
Jia, Fei
Kassel, Jennifer
Kong, Hanfu
Kumar, Jitesh
Lane, Jesse Ethan
Leshin, Jeremy
Li, Chih-Hao
McGill, Daniel
Mehta, Naman
Oh, Bumjin
Qin, Yangyang
Rakes, Colin
Saghaye-Polkoo, Sajad
Shah, Tarj
Woodruff, Justin
Yang, Geng
Yin, Kun
Zhang, Da
Zhu, Weibin

ADVISOR/PROGRAM

Pang
Non Thesis-Thomas
Non Thesis-Fathpour
Lyakh
Amezcu-Correa
Non Thesis-Renshaw
Chang
Thomas
Non Thesis-M. Richardson
Non Thesis
Fathpour
K. Richardson
Thesis-Schülzgen
M. Richardson
Thesis-Amezcu-Correa
Non Thesis
Renshaw
Non Thesis
Non Thesis
Kuebler
Wu
Thesis-Amezcu-Correa
Thesis-Amezcu-Correa

Master's Graduates

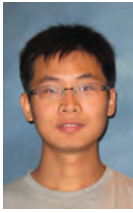
STUDENT

Dhasmana, Nitesh
Fisher, Chris
Kassel, Jennifer
Lane, Jesse Ethan
Mehta, Naman
Qin, Yangyang
Rakes, Colin
Zhang, Da
Zhu, Weibin

GRADUATING TERM

Summer 16
Spring 17
Fall 17
Summer 16
Summer 16
Spring 17
Spring 17
Spring 17
Spring 17

PHD POST-GRADUATION EMPLOYMENT

**Mingxin Li**

PhD Optics & Photonics, Summer 2016
Advisor: Dennis Deppe
Title: Sr. Engineer Mfg Process Development
Employer: Lumentum, San Jose CA

**Amy Van Newkirk**

PhD Optics & Photonics, Summer 2016
Advisor: Axel Schülzgen
Title: Post Doctoral Scholar
Employer: Pennsylvania State Univ Electro-Optics Center

**Xu Yang**

PhD Optics & Photonics, Summer 2016
Advisor: Dennis Deppe
Title: Faculty Researcher
Employer: Nanjing University

**Jeffrey Taylor Chiles**

PhD Optics & Photonics, Fall 2016
Advisor: Sasan Fathpour
Title: Post Doctoral Fellow
Employer: NIST Time and Frequency Division, Boulder CO

**Peng Zhao**

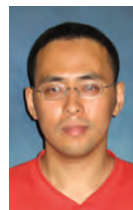
PhD Optics & Photonics, Fall 2016
Advisor: David Hagan, Eric Van Stryland
Title: Post Doctoral Scholar
Employer: UCF, College of Optics & Photonics

**Seyed Hossein Hodaee Esfahani**

PhD Optics & Photonics, Spring 2017
Advisor: Mercedeh Khajavikhan
Title: Sr. Photonic Integrated Circuit Engineer
Employer: Lumentum

**Fenglin Peng**

PhD Optics & Photonics, Spring 2017
Advisor: Shin-Tson Wu
Title: Research Scientist
Employer: Facebook, Seattle, WA

**Tiansi Wang**

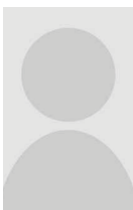
PhD Optics & Photonics, Spring 2017
Advisor: Aravinda Kar

**Antoine Lepicard**

PhD Material Science, Fall 2016
Advisor: Kathleen Richardson
Title: Scientist
Employer: Aquitaine Science Transfert, France

**William Taylor Shoulders**

PhD Material Science, Fall 2016
Advisor: Romain Gaume
Title: Research Staff
Employer: ARL Aberdeen, MD

**Ahmed El Halawany**

PhD Physics, Fall 2016
Advisor: Demetrios Christodoulides
Title: Research Scientist
Employer: UCF, College of Optics & Photonics

**Zeinab 'Zahoora' Sanjabi Eznaveh**

PhD Physics, Spring 2017
Advisor: Rodrigo Amezcua-Correa
Title: Research Scientist
Employer: UCF, College of Optics & Photonics

**Roxana Rezvani Naraghi**

PhD Physics, Spring 2017
Advisor: Aristide Dogariu
Title: Sr. Researcher
Employer: ASML, Wilton CT.

**Haider Ali**

PhD Material Science, Spring 2017
Advisor: Winston Schoenfeld
Title: Post Doctoral
Employer: UCF, College of Optics & Photonics

COLLOQUIA AND SEMINARS

DATE	SPEAKER	TITLE
1/09/2017	Kyle Douglass École Polytechnique Fédérale de Lausanne (EPFL)	Optimizing Super-Resolution Microscopy for High-Throughput Imaging and Cell Biology (OSA Student Chapter Alumni Talk)
1/26/2017	C. Kumar N. Patel Pranalytica, Inc.	Infrared Optics is Still Hot Research! (Distinguished Seminar Series)
1/27/2017	Nitin Padture Brown University	The Unprecedented Promise of Perovskite Solar Cells for Cheap Renewable Energy (NSTC/CREOL Distinguished Seminar Series)
2/02/2017	Koray Aydin Northwestern University	Flat Nanophotonics: Controlling Light at the Nanoscale with Plasmonics and Metasurfaces
2/03/2017	Alex Vitkin University of Toronto	Photon Mayhem: Using Light for Structural and Functional Assessment of Biological Tissues (SPIE Student Chapter Seminar)
2/03/2017	Knut Michel TRUMPF Scientific Lasers	OPA Driven by Thin-Disk Lasers
2/10/2017	Charles Middleton Harris Corporation	The use of Photonics for the Transmission and Processing of Microwave Signals (SPIE Student Chapter Seminar)
2/20/2017	Carol Ann Dykes UCF Business Incubator	Thought Process and Steps of Starting a Scientific Company (OSA Student Chapter Seminar Series)
3/06/2017	Jerome V. Moloney University of Arizona	New Paradigm for multi-TW MWIR and LWIR Atmospheric Propagation over Kilometer Ranges
3/13/2017	Kenichiro Masaoka NHK Science and Technology Research Laboratories	Wide-Gamut UHDTV System Colorimetry and Display Gamut Metrology (SID Student Chapter Seminar)
3/16/2017	Mathias Fink Langevin Institute	Time Reversal and Holography with Time Transformations (Distinguished Seminar Series)
3/23/2017	Rémi Carminati Institut Langevin, ESPCI ParisTech	A Few Surprises in Multiple Scattering of Light
3/27/2017	Michael Chini UCF/ Physics	Solid-State High-order Harmonic Sources & Spectroscopy
3/28/2017	Quan Li Kent State University	Light-Directing Self-Organized Chiral Liquid Crystalline Nanostructures: From 1D to 3D Photonic Crystals (SID Student Chapter Seminar)
3/31/2017	Aditya D. Mohite Everix	The Emergence of Hybrid-Perovskites for Low-Cost, High-eEfficiency Optoelectronic Devices (NSTC/CREOL Joint Speaker Series)
4/03/2017	J. Stewart Aitchison Canada-India Network Centre of Excellence	Photonics for Point of Care Diagnostics (IEEE Distinguished Seminar Series)
4/03/2017	Amy Oldenburg University of North Carolina at Chapel Hill	Quantifying Brownian, ATP-Driven, and Physiological Motion in tissue with Optical Coherence Tomography: Applications in Breast Cancer and Airway Disease
4/10/2017	Sharon Weiss Vanderbilt University	Exploiting Light-Matter Interaction in Silicon Photonics for Biosensing (IEEE Distinguished Seminar Series)
4/10/2017	Fritz Keilmann Ludwig-Maximilians-Universität	Infrared Near-Field Microscopy and Spectroscopy (NSTC/CREOL Distinguished Seminar)
4/14/2017	Subith S. Vasu UCF-MAE	Using Shock Tube and Time-Resolved Laser Diagnostics for Efficient Power Generation and Propulsion
5/10/2017	Ronald G. Driggers CEO St. Johns Optical Systems	Infrared Systems, Military Imaging, Commercialization, and the Future
5/12/2017	Daniel Marks Duke University	Joint Physical Design and Computed Imaging in Photography, Microscopy, and Nonlinear Optics
5/15/2017	Craig Nie Rutgers University	Rare-Earth-Doped Single-Crystal YAG Fibers Grown by the Laser Heated Pedestal Growth Technique
5/18/2017	Sanjeev J. Koppal University of Florida	Toward Micro Vision Sensors
5/25/2017	Terence Rooney OSA	My Role at OSA – Utilizing Your Needs to Shape our Goals (OSA Student Chapter Talk Series)
7/05/2017	Chain-Shu Hsu National Chiao-Tung University	Design and Synthesis of Liquid Crystals for Organic Thin Film Transistors (SID Student Chapter Seminar)

7/17/2017	Michael Wittek Merck Darmstadt	Liquid Crystals for Non-Display Applications (SID Student Chapter Seminar)
8/16/2017	Jose Rafael Guzman-Sepulveda Ashutosh Rao CREOL/UCF	Real-Time Intraoperative Monitoring of Blood Coagulability via Coherence-Gated Light Scattering Nanophotonic Lithium Niobate Frequency Converters (OSA Graduate Research Symposium)
8/17/2017	Ibrahim Abdulhalim Ben Gurion University	Improved Liquid Crystal Devices are Boosting Optical Imaging (SID & IEEE Joint Student Chapter Seminar)
8/25/2017	David Hagan Kyu Young Han CREOL-UCF	Introduction to Research at CREOL: David Hagan and Kyu Young Han
8/30/2017	Pieter Kik Peter Delfyett CREOL-UCF	Introduction to Research at CREOL: Pieter Kik & Peter Delfyett
9/01/2017	Jayan Thomas Debashis Chanda NSTC-CREOL	Introduction to Research at CREOL: Jayan Thomas & Debashis Chanda
9/06/2017	Romain Gaume Ryan Gelfand CREOL-UCF	Introduction to Research at CREOL: Romain Gaume & Ryan Gelfand
9/13/2017	Ron Driggers Kyle Renshaw CREOL-UCF	Introduction to Research at CREOL: Ron Driggers & Kyle Renshaw
9/15/2017	Armand Niederberger LEIA Inc.	Transitioning from Science into Industry: My Journey from Ultra Cold Atoms to Super-Hot Applications (OSA Traveling Lecturer)
9/20/2017	Aydogan Ozcan UCLA	Democratization of Next-Generation Microscopy, Sensing and Diagnostics Tools through Computational Photonics (IEEE Distinguished Seminar)
9/22/2017	Luca Argenti Physics/CREOL-UCF Axel Schülzgen CREOL-UCF	Introduction to Research at CREOL: Luca Argenti & Axel Schülzgen
9/27/2017	Eric VanStryland Konstantin Vodopyanov CREOL-UCF	Introduction to Research at CREOL: Eric VanStryland & Konstantin Vodopyanov
9/29/2017	Kyle Renshaw CREOL-UCF Stephen Kuebler Chemistry-UCF	Introduction to Research at CREOL: Kyle Renshaw & Stephen Kuebler
10/02/2017	Guodong Xie USC	Boost the Communication Data Rate Using Beams Carrying Orbital Angular Momentum(OAM)
10/04/2017	Ronald Driggers CREOL-UCF	Introduction to Research at CREOL: Ronald Driggers
10/06/2017	Ronald Driggers CREOL-UCF	Career Advice for Graduate Students, Post-Docs, and Young Faculty (SPIE Student Chapter Faculty Talk Series)
10/11/2017	Leonid Glebov Xiaoming Yu CREOL-UCF	Introduction to Research at CREOL: Leonid Glebov & Xiaoming Yu
10/12/2017	Larry C. Andrews, TLI/CREOL	Tutorial on Laser Beam Propagation Through Random Media
10/27/2017	Kumar N. Patel Pranalytica, Inc./CREOL-UCF	Fun with Fast (but not Furious) Tunable Lasers in the Infrared
10/30/2017	Xiao-Feng Qian University of Rochester	Completing Bohr's Complementarity
11/30/2017	Rick Schwerdtfeger NSF	NSF SBIR/STTR Program
12/01/2017	Rongwen 'Luke' Lu Howard Hughes Medical Institute	Rapid two-photon volumetric functional imaging of brain with synaptic resolution (Biophotonics Faculty Candidate)
12/07/2017	Sahin K. Özdemir Pennsylvania State University	Photonics at the Exceptional Points: From Optical Sensing to Optomechanics
12/08/2017	Chi Zhang Boston University	Stimulated Raman Spectroscopic Imaging for Biology and Medicine (Biophotonics Faculty Candidate)
12/11/2017	Leo Keller AU Optronix	Automotive LCD Smart-Glass Applications in Europe (SID Student Chapter Seminar)

RESEARCH

The faculty, scientists, and students of CREOL, The College of Optics and Photonics, engage in research in areas utilizing radiation at wavelengths extending from millimeter waves to X-rays and cover the basic science and physics of optics and photonics, as well as prototyping development and demonstration of feasibility of applications. They vigorously pursue joint research projects with industry, academia, and government laboratories. In addition to CREOL (Center for Research and Education in Optics and Lasers), which is the primary research arm of the College, three centers are also active:

RESEARCH CENTERS

FLORIDA PHOTONICS CENTER OF EXCELLENCE (FPCE)

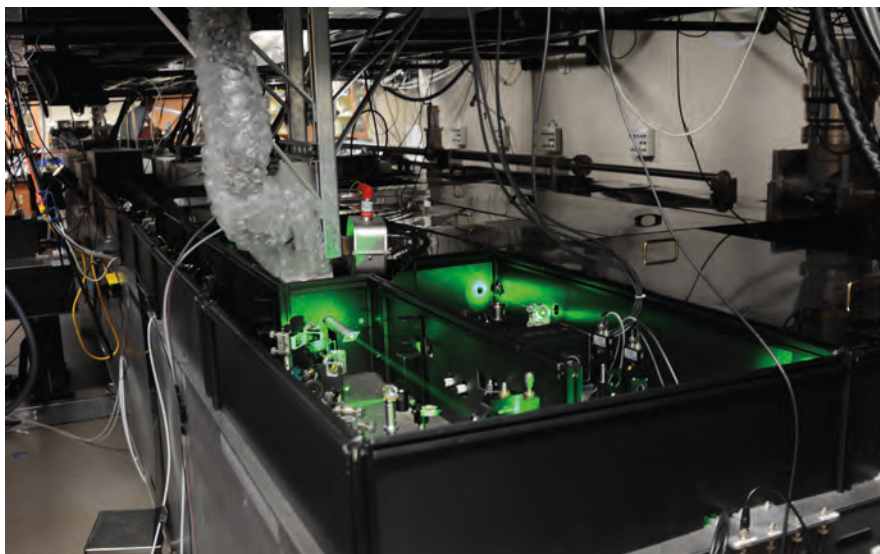
The FPCE was established with a \$10 million grant from the State of Florida to create a new center of excellence within The College of Optics and Photonics at the University of Central Florida. The program began in 2003 with three primary goals: Advance excellence in research and graduate education to serve existing and emerging industry clusters in the state (photonics, optics, lasers), leverage state resources via partnerships with industry and government, and work in partnership with local, state and regional economic development organizations to attract, retain and grow knowledge-based, wealth producing industries to Florida. The focus of the FPCE research and education work has been on the technologies of nanophotonics, biophotonics, advanced imaging and 3D displays, and ultra-high bandwidth communications, all of which are forecast to experience rapid market growth. The grant has been used for developing the research infrastructure (new faculty, new facilities, new equipment), funding competitive R&D Partnership Projects at Florida universities in partnership with Florida industry, and pursuing commercialization and outreach with the help of the FPCE Industrial Advisory Board, the UCF Technology Incubator, and the Florida Photonics Cluster.

TOWNES LASER INSTITUTE

The Townes Laser Institute was established in 2007 in the presence of and in honor of Charles Townes, inventor of the concept of the laser, and a 1964 Nobel Laureate for Physics. Established for the development of next-generation lasers and their uses in medicine, advanced manufacturing and defense applications, the Institute was funded by a \$4.5M grant from the State of Florida, together with matching funds from UCF for 5 faculty positions and \$3M for start-ups and infrastructure. Since its founding, the Townes Laser Institute has grown to a faculty of 14 and has developed major capabilities in optical fibers, attoscience and new laser materials. It has made significant investments in optical fiber pulling facilities, pre-form fabrication, glass science and processing. It is currently building up a comprehensive capability in transparent ceramic laser materials. Future areas of investment include mid-infrared sources and materials, medical laser technology, laser-bioengineering, advance laser-based manufacturing and new defense-related laser technologies including long-distance laser light propagation through the atmosphere. The Townes Laser Institute is directed by Peter Delfyett.

INSTITUTE FOR THE FRONTIER OF ATTOSECOND SCIENCE AND TECHNOLOGY (iFAST)

The Institute for the Frontier of Attosecond Science and Technology (iFAST), directed by Prof. Zenghu Chang, is established in 2013. At the present time, iFAST has 6 research groups dedicated to research, education and outreach of attosecond physics and optics. The mission is to provide unique opportunities for faculty, scientists and students from College of Science and CREOL to closely collaborate in attosecond science research, create and disseminate new knowledge in attosecond physics by conducting, presenting, and publishing cutting-edge fundamental and applied research and develop next generation attosecond lasers for technology transfer and creating jobs in the State of Florida and the nation. An \$8 million DARPA PULSE and a \$7.5 million MURI are awarded to Chang and his collaborators to develop high energy and ultrashort attosecond light sources.



Dr. Zenghu Chang's Attosecond Laboratory.

AREAS OF RESEARCH



Five major photonic technologies are pursued in the College: 1) lasers, 2) optical fibers, 3) semiconductor and integrated photonic devices, 4) nonlinear and quantum optics, and 5) imaging, sensing and display. Each of these technologies have applications in industry, communication and information technology, biology and medicine, energy and lighting, aerospace, and homeland security and defense. Design of optical systems, which has been the core of optical engineering, remains a principal component of the optics discipline, but advanced topics such as nano-photonics, attosecond optics, meta-materials, plasmonics, and biophotonics, are being embraced as areas of strength and future growth. The College is well positioned to take advantage of the revolution taking place in several areas enabled by optics and photonics. The following list describes some of the details of each research area and the applications pursued. A list of the faculty active in each of these areas and their specializations is available at <http://www.creol.ucf.edu/Research/>.

LASERS

Science and Technology

- ▲ Solid State Lasers
- ▲ Ceramic Lasers
- ▲ Semiconductor Lasers
- ▲ EUV & X-ray Lasers
- ▲ High Power Lasers
- ▲ Ultrafast Lasers
- ▲ Optical Frequency Combs
- ▲ Attosecond science

Applications

- ▲ Laser Fabrication & Lithography
- ▲ Laser Material Processing
- ▲ Lasers in Medicine



Laser and Plasma Laboratory

OPTICAL FIBERS

Science and Technology

- ▲ Fiber Fabrication Technology
- ▲ Multimaterial Fibers
- ▲ Nano-structured Fibers
- ▲ Mid Infrared Fibers
- ▲ Fiber Lasers

Applications

- ▲ Fiber Optic Communication
- ▲ Fiber Optic Networks
- ▲ Fiber Optic Sensing



One of two fiber draw towers in the college.

OPTOELECTRONICS & INTEGRATED PHOTONICS

Science and Technology

- ▲ Epitaxial Growth
- ▲ LEDs & Laser Diodes
- ▲ Quantum Dots & Nanostructures
- ▲ Optoelectronics
- ▲ Oxide Semiconductors
- ▲ Photovoltaics
- ▲ Integrated Optics
- ▲ Periodic Structures & Photonic Crystals
- ▲ Nanophotonics & Plasmonics
- ▲ Silicon Photonics
- ▲ Gratings & Holographic Optical Elements

Applications

- ▲ Optical Communication
- ▲ Optical Processing & Switching
- ▲ Solar Energy Applications
- ▲ Integrated-Optic Sensing
- ▲ Integrated-Optic Signal Processing



Molecular Beam Epitaxy Laboratory

NONLINEAR & QUANTUM OPTICS

Science and Technology

- ▲ Nonlinear Guided Waves & Fibers
- ▲ Nonlinear Optical Materials
- ▲ Nonlinear Optics & Spectroscopy
- ▲ Nonlinear Optics in Periodic Structures
- ▲ Photosensitive Glasses
- ▲ Quantum Optics
- ▲ Solitons

Applications

- ▲ Laser Protectors
- ▲ Quantum Communication & Information
- ▲ Lasers in Medicine



Demonstration of white light continuum generated by high power laser.

SENSING, IMAGING, & DISPLAY

Science and Technology

- ▲ Optical Design & Image Analysis
- ▲ Near Field Imaging
- ▲ Propagation in Random Media
- ▲ X-ray & EUV Technology
- ▲ Infrared Sensors & Systems
- ▲ Millimeter & THz Technology
- ▲ Optics of Liquid Crystals

Applications

- ▲ Laser Protectors
- ▲ Quantum Communication & Information



Intraoperative real-time blood monitoring: Fiber-optic technology allows for the real-time monitoring of blood coagulability in the operating room.

LABORATORIES AND FACILITIES

The main facilities of the College are housed in a state-of-the art 104,000 sq. ft. building dedicated to optics and photonics research and education. Other facilities, like the Optical Materials Laboratory (pictured below) are located on the main UCF campus.

COLLEGE FACILITIES

NANOPHOTONICS SYSTEMS FABRICATION FACILITIES

A 3,000 ft² multi-user facility containing Class 100 and Class 1000 cleanrooms and a Leica 5000+ e-beam lithography instrument capable of 10-nm resolution. These facilities are used for fabrication and study of nanostructured materials and nanophotonic integrated circuits. The facility equipment includes a Suss MJB-3 and MJB-4 aligners, 2 Plasma-Therm 790 RIE systems with silicon and III-V etching capabilities, a Temascal and V&N E-beam evaporators, along with an atomic force microscope, a profilometer, a rapid thermal annealer, a bonder, a scribe and a microscope. The Laboratory is designed and operated as a multi-user facility, with availability to companies and other outside users. Rm 180.

OPTOELECTRONIC FABRICATION CLEANROOM

800 sq. ft. multiuser facility containing class 100 and class 10,000 cleanrooms. Used in the development of optoelectronic semiconductor devices. The facility includes a Suss MJB-3 aligner, a Plasma-Therm 790 RIE/PECVD, an Edwards thermal evaporator, and a bonder, scribe, and microscope. Rm 211

SCANNING ELECTRON MICROSCOPE (SEM) FACILITY

Vega SBH system built by Tescan is a tungsten-filament scanning electron microscope. The system is designed with a fully electronic column and is capable of imaging from 1–30 keV with nanometer scale resolution. Additionally, the system is equipped with the state of the art sample positioning stage with 5 nm resolution and a full scale travel of 42 mm. The shared SEM is ideal for checking the fidelity of travel of 42 mm. The shared SEM is ideal for checking the fidelity of the microfabrication routinely performed in the CREOL cleanroom. Rm 176

MACHINE SHOP

Has two modern Sharp LMV milling machines and a 16–50G lathe capable of achieving the tolerances required for the instruments used in CREOL. Classes are offered to qualify research scientists and students to safely modify and construct instruments critical to their research. Rm A106. Richard Zotti.

OPTICAL MATERIALS LABORATORY (OML)

The Optical Materials Laboratory (OML) is a new 4,000 square-foot facility with state-of-the-art laboratory fabrication and characterization capabilities for research in optical ceramics, IR glasses and glass-ceramics as well as optical fibers. It features dedicated ceramic laboratories with extensive powder processing and sintering equipment, IR glass and glass-ceramic advanced manufacturing, and cutting-edge MOCVD fiber-preform fabrication laboratory. These laboratories also include dedicated analytical tools and post-processing capabilities offering student training opportunities in these areas. The OML is located on the UCF main campus (Building 154 on 12765 Ara Drive) in close proximity to the Material Characterization Facility (MCF).

CARY SPECTRA-PHOTOMETER AND MICROSCOPE

Cary 500 is Spectrophotometer that is capable of measuring light absorption in both transmitted and reflected light in the UV, visible and near IR spectrum. Rm 159

ZYGO FACILITY

Rm 211B. Shared facility administered by Martin Richardson.

TOWNES INNOVATIVE SCIENCE & TECHNOLOGY FACILITY (TISTEF)

The TISTEF site is a secure facility located at the Kennedy Space Center, Florida. It was a Navy SSC PAC operated facility, but is now an Air Force facility on NASA property, managed and operated by UCF.



The Laser Optics Turret & Instrumentation System (LOTIS) tracking mount at TISTEF, Kennedy Space Center.

TISTEF was originally built in 1989 to support the Strategic Defense Initiative Organization's Innovative Sciences and Technology Office (SDIO/ISTEF). Today TISTEF has a much broader mission; it supports research and development of electro-optics sensing technologies for DOD, commercial and academic applications. DOD customers include: the Army, Navy Air Force, DARPA, and DIA. The facilities include a laser and optics laboratory, a 1 km laser test range, a precision tracker (gimbal) with a 0.5 meter telescope and coude mirror path (for laser transmission), and several transportable trackers capable of supporting active (laser) or passive testing at remote sites. Additionally, TISTEF maintains an assortment of telescopes, optics, and sensors to support various data collection requirements. Since TISTEF is a tenant of the 45th Space Wing and NASA, operating agreements are in place that permit tasking AF Eastern Range and NASA assets as needed. It also has standardized range operations and procedures for laser testing against boosting rockets, satellites, and other terrestrial targets. TISTEF has a close partnership with the CREOL which provides access to cutting edge R&D and expertise in atmospheric propagation of lasers, laser communications, laser radar (LADAR), fiber-optic lasers, passive imaging, and optical design.

FACULTY FACILITIES

DIFFRACTIVE AND HOLOGRAPHIC OPTICS LAB

Conducting rigorous analysis, design, and demonstration of diffractive and holographic optical elements, subwavelength grating structures and their applications, E-M theory of grating diffraction, holographic optical information processing and storage, volume holography. Leonid Glebov.

DISPLAY AND PHOTONICS LAB

Developing 1) Advanced displays including LCDs, quantum dots, perovskites, LEDs, OLEDs, augmented reality and virtual reality,

and sunlight readable displays, 2) Adaptive lenses for tunable-focus lens, optical imaging and light field displays, and 3) Adaptive optics for wavefront correction and laser beam control. Shin-Tson Wu.

FIBER OPTICS LAB

Research in fiber fabrication technology, nano-structured fibers, nonlinear fiber materials, fiber lasers, and fiber sensing applications. Axel Schülzgen and Rodrigo Amezcua.

FLORIDA ATTOSECOND SCIENCE AND TECHNOLOGY LAB

Generation of attosecond (10⁻¹⁸ s) and zeptosecond (10⁻²¹ s) X-ray pulses. Zenghu Chang.

GLASS PROCESSING AND CHARACTERIZATION LABORATORY (GPCL)

Investigating the design, processing methodologies, fabrication and characterization of novel oxide and non-oxide glass and glass ceramic materials for the infrared. Applications include, on-chip sensors, bulk and film materials for GRIN, optical nanocomposites, 3D printing of chalcogenide materials. Kathleen Richardson.

INTEGRATED PHOTONICS & ENERGY SOLUTIONS LAB

Specializing in fundamental and technological aspects of silicon-based optoelectronic devices and chips, including their energy efficiency issues. The lab encompasses near- and mid-infrared setups for characterizing the devices fabricated in CREOL's Nano Fabrication Facility. Sasan Fathpour.

LASER ADVANCED MATERIAL PROCESSING (LAMP)

Engaged in novel manufacturing technology; new materials synthesis including optical, electronic and magnetic materials for a variety of applications such as sensors, detectors and medical devices; and process physics modeling. Aravinda Kar.

LASER AIDED MATERIALS PROCESSING LABS

Investigating the interaction of lasers with absorbing and non-absorbing materials, growth, solidification, and plasma effects; laser CVD; laser ablation, laser drilling, cutting, welding; developing process-monitoring and diagnostic techniques. Stephen Kuebler (NPM) and Martin Richardson (LPL).

LASER PLASMA LAB

Conducting research on X-ray and EUV optics and sources, X-ray microscopy, laser-aided material processing, and laser generated plasmas. Martin Richardson.

LASER SYSTEM DEVELOPMENT LABS

Developing new solid-state lasers, external cavity semiconductor lasers and amplifiers, seeding lasers, laser-induced damage, far infrared semiconductor lasers, high-average-power solid state lasers, semiconductor and solid state volume Bragg lasers, high power laser beam combining, ultra-high-intensity femtosecond lasers, new solid state lasers and materials development (crystals & glasses). Michael Bass, Martin Richardson, Peter Delfyett, Leonid Glebov.

LIQUID CRYSTAL DISPLAY LAB

Investigating 1) advanced liquid crystal display materials, display devices, and device modeling, 2) electronic laser beam steering and adaptive optics using fast-response spatial light modulators, 3) adaptive liquid crystal and liquid lenses for foreveated imaging and zoom lens, and 4) bio-inspired tunable optical filters using cholesteric liquid crystals. Shin-Tson Wu.

MID-INFRARED COMBS GROUP (MIR)

Broadband mid-infrared ($\lambda > 2.5 \mu\text{m}$) frequency combs generation based on subharmonic optical parametric oscillators. Trace molecular sensing and coherent dual-comb spectroscopy using

octave-wide MIR combs. Biomedical applications of frequency combs. Photonic THz wave generation and THz imaging. Nano-IR spectroscopy. Konstantin Vodopyanov.

MULTI-MATERIAL OPTICAL FIBER DEVICES LAB

Research on novel optical fiber structures, nanophotonics, fiber-based optoelectronic devices, optical imaging using large-scale three-dimensional arrays constructed from photosensitive fibers, and mid-infrared fiber nonlinear optics. Ayman Abouraddy.

MULTIPLE QUANTUM WELLS LAB

Research on the design, fabrication and testing of novel all-optical switching devices using III-V multi-quantum well semiconductors, and the integration of high-speed optical and optoelectronic devices to form monolithic integrated optical circuits for high data throughput optical networks. Patrick LikamWa

NANOPHOTONIC DEVICES LAB

Research in epitaxial growth and properties of oxide semiconductors, oxide and nitride-semiconductor light emitting diodes, self-assembled quantum dots, and e-beam nano-lithography. Winston Schoenfeld.

NANOBIOPHOTONICS LAB (NBPL)

Developing nanoaperture optical trapping based single molecule biophysics methods for studying protein dynamics, structure, and behavior; protein-protein and protein-small molecule interactions; drug discovery; and fundamental life sciences. Ryan Gelfand

NANOPHOTONICS CHARACTERIZATION LAB

Optical analysis tools for investigation of nanostructured devices including Near-field Scanning Optical Microscope, fiber-coupled microscope for single particle spectroscopy, leakage radiation setup for surface plasmon imaging, near-infrared waveguide analysis setup, and variable temperature photoluminescence setup. Projects include manipulation of surface plasmon dispersion in nanoscale thin films, enhancement of erbium excitation in semiconductor nanocrystal doped oxides, and enhancement of optical nonlinearities using plasmon resonances. Pieter Kik.

NONLINEAR OPTICS LABS

Conducting research on a variety of nonlinear optical effects, materials, and devices including nonlinear interactions in waveguides, optical power limiting, and characterizing materials response at femtosecond, picosecond and nanosecond scales. Eric Van Stryland, David Hagan, MJ Soileau.

NONLINEAR WAVES LAB

Research in nonlinear optics, spatial and spatio-temporal solitons, discrete solitons in photonic lattices, and curved beams. Demetrios Christodoulides.



Undergraduate student Latifah Maasarani in Dr. Ryan Gelfand's research lab.

OPTICAL CERAMICS LAB

Conducting research on the synthesis of transparent ceramics, powder processing, ceramic casting, vacuum and pressure sintering, diffusion bonding, dopant diffusion, and crystal growth for laser and nuclear detector applications. Romain Gaume.

OPTICAL COMMUNICATION LAB

High-capacity optical communication through linear and nonlinear channels including free space and optical fiber using synergy of advanced optical and electronic techniques. Guifang Li.

OPTICAL GLASS SCIENCES & PHOTO-INDUCED PROCESSING LAB

Conducting studies of new materials for high-efficiency, robust holographic optical elements; high power laser beam combining, glass spectroscopy, refractometry and interferometry; photo-induced processes in glasses; technology of optical quality and high-purity glasses. Leonid Glebov.

OPTICAL IMAGING SYSTEM LABORATORY

Creating novel imaging systems by integrating physical coding and computational methods for biological research, medical diagnosis, and industrial imaging applications in both visible and X-ray regimes. Shuo "Sean" Pang.

OPTICAL NANOSCOPY LAB

Developing and applying novel optical tools such as fluorescence nanoscopy (super-resolution imaging) and single-molecule imaging to study essential problems in biology and neuroscience. Kyu Young Han

OPTICAL IMAGING SYSTEM LAB (OISL)

Research in OISL is focused on developing computational imaging platforms for biomedical research, medical diagnosis, and industrial imaging applications in both visible and X-ray regimes. Research topics include Computational Imaging, Coded Aperture, X-ray Tomography, X-ray Scatter Imaging, Fluorescence Microscopy, Lens-less Optical Imaging, Bio-sensor and Portable Imaging Devices. Shuo "Sean" Pang

PLASMONICS AND APPLIED QUANTUM OPTICS LAB

Developing nanoscale emitters using metallic structures, study the dynamic response of nanoscale lasers. Generation and characterization of non-classical light. (Mercedeh Khajavikhan) (PAQO).

PHOTONICS DIAGNOSTIC OF RANDOM MEDIA

Exploring different principles for optical sensing, manipulation of electromagnetic fields, and phenomena specific to optical wave interactions with complex media. Aristide Dogariu.

QUANTUM OPTICS LAB

Conducting research on the generation and detection of nonclassical light, such as entangled photons, and its quantum information applications, including quantum imaging and quantum communication. Bahaa Saleh, Ayman Abouraddy.

SEMICONDUCTOR LASERS LAB

A III-V epitaxial growth facility used to research new types of semiconductor heterostructures and devices that include quantum dots, quantum dot laser diodes, vertical-cavity surface-emitting laser diodes, spontaneous light sources, and single quantum dots. A characterization laboratory is used to study the optical properties of the samples, including their light emission, microcavity effects, and laser diode characteristics. Dennis Deppe.

THIN-FILM OPTOELECTRONICS LAB

Developing novel optoelectronic materials and devices for sensors, solar cells, lighting and displays that are large area, flexible, cost-effective and efficient. Kyle Renshaw

ULTRAFAST PHOTONICS LABORATORY

Conducting research on ultrafast high power optical pulses from semiconductor diode lasers, for applications in applied photonic networks and laser-induced materials modification. Peter Delfyett.

INSTRUCTIONAL LABORATORIES

APPLIED OPTICS LABORATORY

Laboratory techniques for observing optical phenomena and quantitative experimental study of geometrical optics, optical interferometry, diffraction, and image processing.

LASER ENGINEERING LABORATORY

Designing and device implementation of diode pumped solidstate lasers, nonlinear frequency conversion, Q-switching, mode locking, and pulse second harmonic generation.

PHOTONICS LABORATORY

Experimental study of photonic devices and systems including liquid crystal displays, fiber-optic sensors, laser diodes, electro optic modulation, acousto-optic modulation, lightwave detection, optical communications, and photonic signal processing.

OPTOELECTRONIC DEVICE FABRICATION LABORATORY

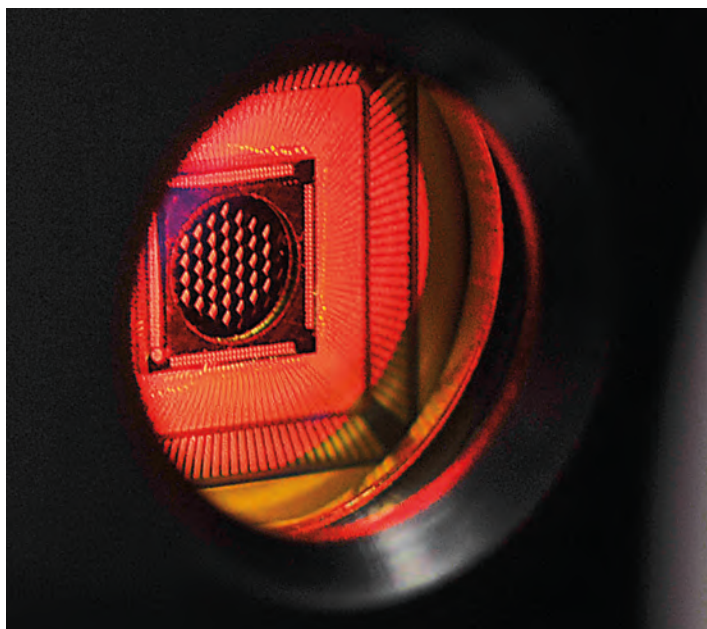
Design and micro-fabrication of semiconductor optoelectronics devices including passive waveguides, light emitting diodes (LEDs), laser diodes (LDs), photodetectors. Prerequisite Course: Graduate standing or consent of the instructor.

UNDERGRADUATE LABORATORY

A multipurpose space that accommodates laboratory courses for Optoelectronics, Fiber Optics, Introduction to Photonics, Laser Engineering, and Imaging and Display. The space includes basic instrumentation necessary to conduct experiments.

SENIOR DESIGN LABORATORY

Comprised of six laboratory benches, the Senior Design laboratory space is designed to permit students with flexibility to design, test, and construct their Senior Design projects. Students have access to this space in the semester in which they are enrolled in OSE 4951 and OSE 4952, the Senior Design Courses. They are able to work in this space at any time, day or night.



A deformable mirror device used to convert the Gaussian beam profile from a laser to non-Gaussian shape in Dr. Xiaoming Yu's laboratory.

Nondegenerate Two-Photon Gain in Semiconductors

Lasers operate by stimulated emission, where a single photon is emitted per electronic transition. Two photons, with combined energy matching the transition energy, can also stimulate emission of two additional photons in a process known as two-photon gain (2PG). Just as linear (single-photon) absorption changes into stimulated emission with population inversion, two-photon absorption (2PA) changes into 2PG. The inherent nonlinearity of 2PG gives rise to interesting properties of potential two-photon lasers, such as pulse compression, self-mode locking, and unique photon statistics. Their most exciting feature arises from the fact that there is no requirement on the energies of the individual photons, so long as their sum matches the transition energy. Thus, by choosing a wide-gap semiconductor like GaN, a two-photon laser has the potential to be continuously tunable from the UV to the IR. The only requirement on the semiconductor is, like any semiconductor laser, it must have a direct bandgap.

A Two-photon laser may be continuously tunable across the entire optical spectrum

Professors David Hagan and Eric Van Stryland, along with 2015 PhD graduate Matthew Reichert, currently a postdoc at Princeton University, have spent many years measuring 2PA in semiconductors and have determined that the already large 2PA coefficient for pairs of equal energy photons is enhanced by 2 to 3 orders of magnitude when the photon pairs have very different energies (photon energy ratios of ~ 10). This extremely nondegenerate (END) enhancement translates directly to 2PG, making semiconductors likely candidates for END 2PG media.

The team has already demonstrated END 2PG in optically excited GaAs via femtosecond pump-probe experiments, as shown in Fig. 1. The transmittance of a probe pulse, with a wavelength of 977 nm, corresponding to a photon energy $\sim 90\%$ of the band gap, is measured versus temporal delay of an infrared

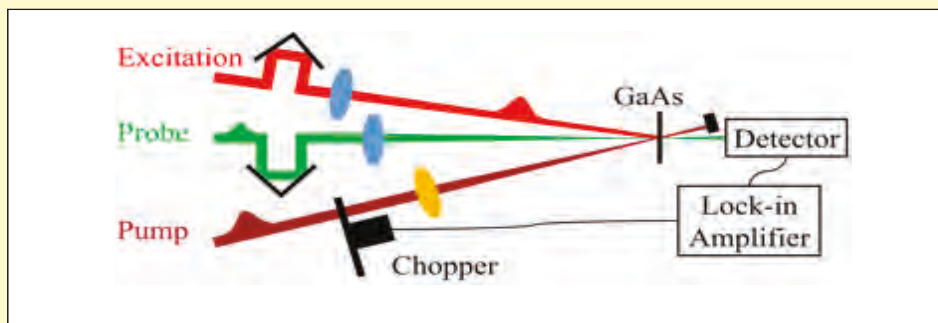


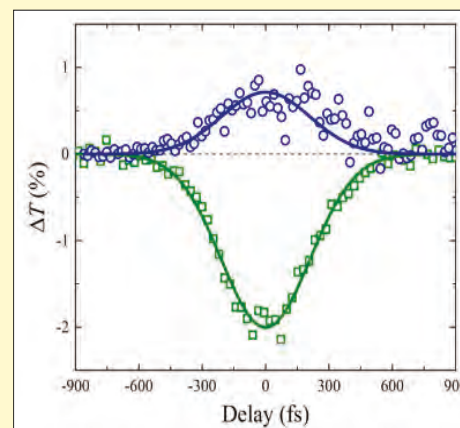
Diagram of the experimental set-up showing Pump and time-delayed Probe having very different wavelengths. The above-gap Excitation beam is temporally positioned to create excited carriers ~ 10 ps prior to the arrival of the Pump.

pump pulse at $7.75 \mu\text{m}$. With the above gap excitation at 780 nm turned off, 2PA loss is observed, while with the excitation on a few picoseconds before the pump, 2PG is observed.

These experiments constitute the first demonstration of highly nondegenerate 2PG in any medium. An END 2PG coefficient of more than 25X the

degenerate, i.e. equal energy 2PA coefficient, was measured, confirming that nondegenerate enhancement of 2PA in semiconductors enhances 2PG as well. Such enhancement may open the way towards the development of two-photon semiconductor lasers.

Note that the 2PG observed was not a net gain, as there are several background absorption processes that combine to exceed the maximum 2PG observed so far. These losses include free-carrier absorption, which is typically high in the mid infrared, and three-photon absorption (3PA). It turns out that 3PA is also enhanced in the END case and this places an upper limit on the irradiance and thus the obtainable 2PG. In bulk semiconductors, it appears that this may preclude a 2-photon laser; however, the team's theoretical calculations indicate that with proper design, another order of magnitude enhancement of 2PG (and 2PA) can be obtained in multiple quantum-well structures



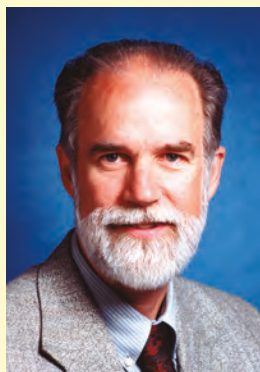
Pump-probe experiments without excitation showing 2PA (green squares), and with excitation showing 2PGain (blue circles).

while reducing free-carrier absorption and the eliminating the enhancement of 3PA.

Van Stryland, Hagan and their students are currently investigating the 2PA and 2PG in waveguide structures of multiple quantum well structures grown at Sandia National Labs. The results of these experiments will help chart the course for the realization of semiconductor lasers with net gain.

Of course, even after overcoming the issues of parasitic loss and showing that net gain is possible, several challenges to advancing to a free-running, 2-photon semiconductor laser device remain. Most significant of these is the suppression of single-photon emission. Although this is not currently on the team's list of priorities, long-term solutions may include selective wavelength suppression, such as by absorption or by the incorporation of photonic bandgap structures in the laser devices. Should the CREOL research team succeed in its goal of demonstrating net 2PG, it is certain that many researchers and laser manufacturers will have a strong interest in solving these practical problems.

For further information see M. Reichert, et al., Phys. Rev. Lett. 117, 073602 (2016).



Eric Van Stryland



David Hagan



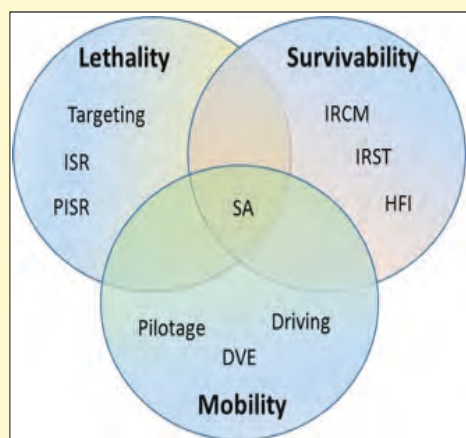
Matthew Reichert

New Sensors for Infrared Imaging Systems

Infrared imaging systems encompass a wide variety of technologies and applications. Technologies range from new infrared detector materials and devices to new optical materials and methods. The applications are primarily military, but security and commercial applications continue to grow rapidly as infrared components become more affordable.

The military applications can be grouped in typical areas of lethality, survivability, and mobility. Lethality applications include targeting, intelligence-surveillance-reconnaissance (ISR), and persistent-ISR or PISR. Target involves discrimination of targets at long range, ISR involves large area imaging, and persistent ISR involves tracking people, vehicles, and maritime craft. Survivability applications comprise infrared countermeasures (IRCM) which is the act of defeating a ground-to-air missile, infrared search and track (IRST) which is long range aircraft/drone detection, and hostile fire indication (HFI) which is small arms detection. Finally, mobility applications are both daytime and night pilotage, driving, and operations in degraded visual environments (DVE). Situation awareness (SA) is the collective state of all sensor inputs and the tools for understanding the current and past status of operations.

All of the applications described above require high performance systems in a competitive environment that naturally requires new and innovative technologies to be developed on a continuous basis. These technologies range from optics to detectors to computational processes (signal and image processing) to new displays. Fundamental questions involve the best bands to operate. The middle figure shows both a tank and a boat in four different infrared bands. The operation performance in each band depends on a huge number of variables to include system component parameters as well as external quantities such as climate, source radiometry, atmospheric transmission, path radiance, turbulence, etc.



Military Applications of Infrared Systems.



Images acquired at different bands can be very different. Bottom tank and boat are VNIR (0.4-1 μm), next up SWIR (1-1.7 μm), third up MWIR (3-5 μm), top is LWIR (8-12 μm).

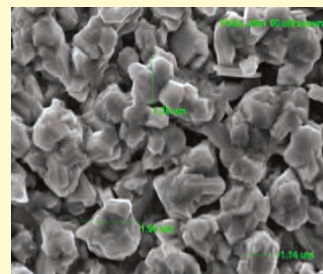
Newer component technologies are making significant contributions to infrared system design and performance. The areas of infrared detectors have seen quantum efficiency in type II superlattice structures increase in the LWIR, high operating temperature (HOT) in the midwave of 150K, and digital readout integrated circuits (ROICS) have allowed much deeper charge well capacity in focal planes resulting in higher signal to noise ratio (SNR).

Professor Ronald Driggers leads an infrared systems team investigating new approaches to sensor design. One project involves a design technique described as pitch-well-processing that combines small-pitch, large format

infrared focal plane arrays with deep well ROICs that enhance SNR. The result is longer range object identification in the infrared.

There has always been a rivalry between MWIR and LWIR bands in infrared systems, especially for targeting applications that occur on fighter jets, attack helicopters, tanks, ships, and many other platforms. In another project the team is currently comparing MWIR and LWIR performance over many different conditions. One particular comparison involves the scattering of MWR versus LWIR in aerosol conditions that degrades target and background contrasts. The group is also studying the optimization of IRST staring systems in support of Air Force Research Laboratory for application to aircraft and unmanned aerial vehicle detection.

Another project aims at investigating a new exciting detector material and detector structures in PbSe. PbSe provides the possibility of the first MWIR high performance detector without having to be cryogenically cooled.



PbSe material for MWIR uncooled detectors.

Driggers and his graduate students are also working with IMEC USA in Kissimmee in the development of new phased arrays in the 100GHz to 3THz regions that will result in low cost mmW/THz cameras. The applications are medical, security, defense, and industrial. IMEC is a world-leading R&D and innovation hub in nanoelectronics and digital technologies



Ronald Driggers

Curved Image Sensors

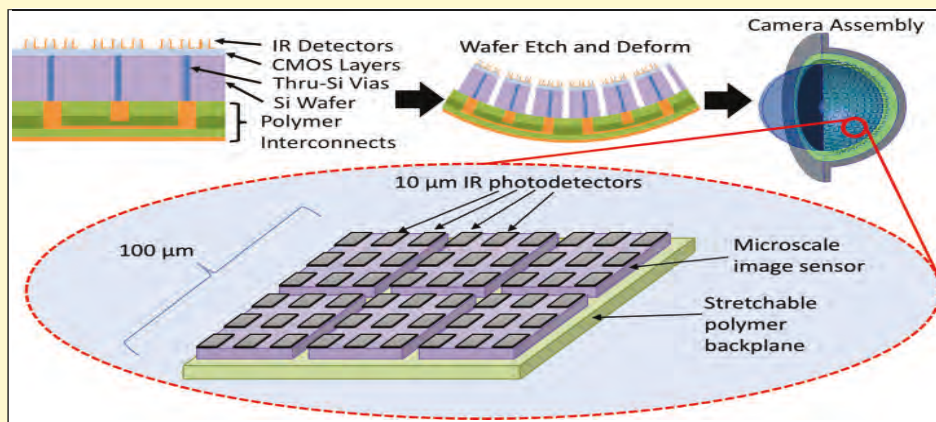
Imaging systems have grown to become ubiquitous pieces of technology found in an ever-increasing range of applications including cell phones, self-driving cars, and refrigerators that photograph their insides. This growth has been facilitated by mobile devices, which have driven camera technologies to smaller form factors and lower cost. Despite individual component advances and the transition to digital sensors, the basic design of camera systems have not changed over the past century; a complex lens is designed to flatten the object scene onto a flat image sensor – but this is about to change.

There are enormous optical advantages to replace the conventional flat sensor with a curved image sensor due to field curvature effects, which cause optical systems to naturally focus to curved surfaces. For example, biological imagers such as the human eye utilize a curved sensor (i.e. the retina) matched to the curved focal surface of a simple lens. This approach provides superior imaging performance in a simple, compact system. Availability of curved image sensors will decouple the traditional constraints between field-of-view (FOV), resolution and image quality; this will enable the biggest revolution in camera systems since the development of digital image sensors. Recent advances in flexible electronics are paving the way to enable the fabrication of curved image sensors and consumer camera manufacturers have already begun erecting intellectual

There are enormous optical advantages to replace the conventional flat sensor with a curved image sensor due to field curvature effects

based on a novel class of materials, organic molecular semiconductors, which can be fabricated directly onto curved glass or plastic substrates. Devices can be fabricated on the curved surface using a high-resolution stamp-transfer patterning processes. This process enables patterning submicron features across the curved surface using a lithographically defined stamp. The team has demonstrated organic photodiodes sensitive across the visible spectrum and into the near infrared with quantum efficiency > 25% and dynamic range > 105.

With the devices and processing technology in place, the team is now developing the technology to scale these photodiodes into mid-sized arrays (<1 megapixel) suitable for ultracompact, wide-FOV imagers. The approach utilizes a novel pixel architecture that leverages layer-by-layer growth capabilities with a simple two-terminal design to minimize the patterning complexity on the curved surface. This vertically-stacked anti-polar diode (VAD) pixel architecture combines an organic photodiode with a blocking diode in a single vertically integrated stack. The result is a pixel with nearly 100% fill factor that only requires two patterning steps with lenient registration requirements. This pixel can be readily fabricated on the curved surface and provides read-out control suitable to address mid-sized



Schematic of hybridized IR image sensor on silicon ROIC with stretchable polymer backplane before and after wafer segmentation etch and deformation, hemispherically curved image sensor assembled with monocentric lens, and exploded view of array of microscale imagers on polymer backplane.

property fences to capitalize on this innovation.

The Thin-Film Optoelectronics (TFO) group at CREOL, directed by Kyle Renshaw, is pioneering fabrication technologies to enable the manufacture of curved image sensors for visible and infrared cameras. The group is pursuing two independent solutions to this challenging problem. The first solution is

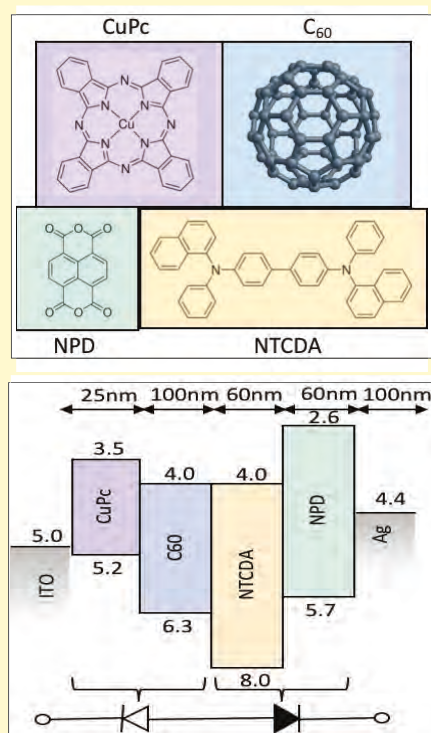
arrays. This solution will provide ultracompact, low-cost, wide FOV imagers ideally suited for vision-based navigation systems.

The TFO group is also developing a second solution to realize curved image sensors based on silicon CMOS read-out integrated circuits (ROICs) – a fundamentally planar technology. This approach will enable large arrays suitable

for high-resolution visible or infrared imaging by leveraging mature CMOS technology and hybridization processes that allow integration of infrared sensitive photodetectors on ROICs. The group is developing a stretchable polymer backplane that is monolithically integrated on the backside of a novel ROIC wafer. This ROIC contains a mosaic of microscale image sensors interconnected through the stretchable backplane. An anisotropic etch between each microscale sensor is used to segment the ROIC wafer and transform the original, rigid, wafer-based circuit into a stretchable circuit carried by the polymer backplane. The stretchable circuit can be deformed into the desired shape using a mold; the group has demonstrated deformation of single-layer interconnects on polymer substrates up to 120° of a hemisphere.



Kyle Renshaw



Organic semiconductor materials, energy band diagram and structure for VAD device

Enabling new optical functionality through multi-phase IR materials

Chalcogenide glass (ChG) – based optical materials that transmit throughout the infrared (IR) have seen increasing use in a diverse range of infrared optical system. In recent years, traditional IR optical systems for the mid-wave infrared (MWIR) and long-wave infrared (LWIR) based solely on ZnS and ZnSe, Si, Ge, and other semiconductor crystalline materials have progressed towards integration with infrared glass and glass ceramic materials. The growth in their use is a result of greater production (by commercial glass manufacturers) and improvements in the know-how of the optics manufacturing protocols (by optics fabrication houses). Such expansion requires investment and training as the expansion of fabrication methods beyond oxide materials requires the optician to not only handle the unique thermal-mechanical properties of new materials but attention to disposal protocols of waste from these non-oxide materials. Unlike oxide optical materials, IR optical manufacturing requires dedicated facilities that prevent cross-contamination, as oxide impurities can dramatically reduce IR transmissivity in important spectral regimes.

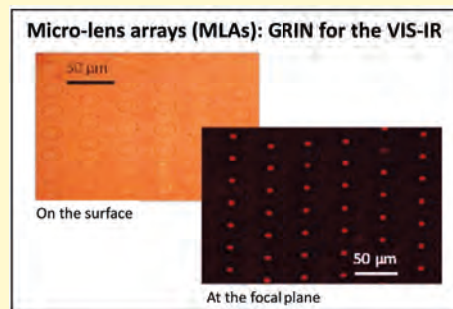
Bulk ChG optics have been integrated into existing airborne imaging systems and are being explored for use as bulk replacements for legacy crystalline (Ge) optics in newer broadband systems, as windows, domes and other free space optical components. Additionally, new physical and solution-based deposition techniques for ChGs developed by Prof. Kathleen Richardson's team and others enable use of ChGs as waveguides, resonators and other micro-optical components compatible with integration processes in next-generation planar photonics on Si, flexible polymers and most recently, on Graphene. These advances enable 'ChG microphotonics' [reported by Richardson's group in CREOL's 2015 Annual Report].

Recently, these activities have been extended to include development of new multi-component, multi-phase chalcogenide alloys (ChAs) which can be glassy or crystalline, as low-loss alternatives to GeSbTe phase change materials (PCMs). ChAs are envisioned as

being low-loss (across the defined IR band(s) of use), electrically- or optically-activated PCMs when integrated onto fixed (solid) or flexible substrates, as depicted below. These activities are currently being supported at UCF through a multi-disciplinary effort as part of DARPA's EXTREME program. The program aims to develop materials and platforms that enable 'tunable' structures based on amorphous, α , crystalline, c, or tailored intermediate multi-phase ($\alpha + c$) materials for a wide variety of applications. While ambitious, the materials and material integration work to realize such goals, shows promise towards the design and fabrication of new material strategies that will enable multi-spectral imaging systems. The figure below illustrates the processing strategy employing solution-derived ChA and their direct application onto a conformal surface followed by the spatially-controlled formation of secondary crystalline phase, which locally induces a change in optical function.

CREOL's Glass Processing & Characterization Laboratory research team, led by Prof. Richardson, works on translating ideas as to how these novel infrared optical materials (in their amorphous, crystalline or their 'multi-phase: glass + crystalline' glass-ceramic (GC) form) can be integrated into novel designs to add new functionality to multi-material systems. Benefiting from industry, government and academic institutional support, her team and collaborators have recently developed a suite of materials and processing methodologies that translate unique optical function onto a range of platforms to yield homogeneous or gradient refractive index (GRIN) behavior with tailorable properties. These materials include ChG or visible diffractive or refractive GRIN components created by thermal poling, chalcogenide GRIN nanocomposites realized by spatially-defined nucleation and growth of a secondary high-index phase in a low-index matrix, ChG-based multi-layer GRIN structures from 3D printed glass layers and laser-written gradient ChG meta-lens structures exploiting laser-induced etch selectivity of the chalcogenide glass films. Details on these findings are summarized in publications on Dr. Richardson's website.

Highlighting one of these examples is the material chemistry optimization to realize stable, long-lived index modification in post-poled ChG micro-lens arrays (MLA's) depicted in the upper right image. Shown (left) is the surface topography of the lenslet array (with RMS surface roughness < 100 nm) and the resulting image (right) at the lenslet's focal plane. Here, the shape and magnitude of the gradient refractive index profile, and the resulting MLA's focal length created in the glass' near-surface layer can be tailored by controlling the size and shape of the transparent electrode pattern used to induce the field. The optical stability of the resulting post-poled structure results not realized in prior efforts on ChGs, arises from the engineering of the glass' network which restricts the mobile ion's (Na⁺)



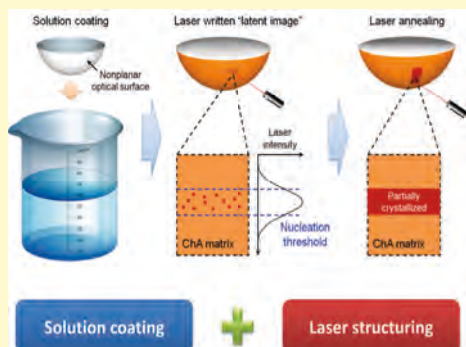
Flat, long-lived microlens arrays created by thermal poling in ChG (in collaboration with University of Bordeaux, ISM).

ability to relax upon removal of the applied field. This patented work, developed as part of a dual PhD project by UCF–Univ. Bordeaux MSE student Dr. Antoine Lepicard, is being evaluated for technology transfer with the Aquitaine Science and Technology office (AST) and UCF.

The common denominator of each of these efforts, is the need for compositional design that addresses not only the spectral window and target optical properties (i.e., refractive index, dispersion, dn/dT) of the materials, but also the manufacturing-related property optimization (hardness, toughness, coefficient of thermal expansion (CTE) and environmental stability (i.e., to moisture or radiation)) needed for the optical component or system they will be integrated into. Beyond these baseline material attributes, is the knowledge towards creating the single- (glass) or multi-phase (glass + crystal) composite's behavior and the underlying material science of how such phase formation and stability behavior impacts the component's absorption, scattering or if appropriate, nonlinear optical property performance as-fabricated, and over time.

With this know-how, and ongoing evidence of successful integration into planar or bulk optical components and systems, further advancement into novel material development can lead to advances in optical functionality not previously observed in homogeneous, single phase optical materials.

For more information, on these and other examples of infrared material and process methodology optimization for IR components, see publications and patents listed on CREOL's website.



Engineered Optical Materials (EnMats) processing strategies based on chalcogenide alloys (ChAs) for creating integrated metasurfaces with freeform optics to enable novel optical functions (courtesy of DARPA EXTREME team: MIT, UMass-Lowell, UCF and LMCO).



Kathleen Richardson

PUBLICATIONS AND PRESENTATIONS

Full-time CREOL faculty authors are highlighted in black; those of joint and courtesy appointments who listed CREOL as one of their affiliations are highlighted in blue; CREOL scientists and students with no faculty co-authors are highlighted in green.

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- P.J. Delfyett**, *Coherent optical signal processing using semiconductor based frequency combs*, APS Annual Meeting, New Orleans, LA, March (2017). **Invited**
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- M.E. Plascak, R. Bustos Ramirez, K. Bagnell, and **P.J. Delfyett**, *Electro-optic comb generation from noise with a photonic filtered optoelectronic oscillator*, IEEE Photonics Conference (IPC), Orlando, FL, WA1.3 (2017).

- R. Bustos Ramirez, M.E. Plascak, K. Bagnell, A. Bhardwaj, J. Ferrara, G. Hoefler, M.C. Wu, and **P.J. Delfyett**, *Optical linewidth and RF phase noise reduction of a chip-scale CPM laser using COEO multi-tone injection locking*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, SM21.2 (2017).
- R. Bustos Ramirez, M.E. Plascak, K. Bagnell, A. Bhardwaj, J. Ferrara, G. Hoefler, M.C. Wu, and **P.J. Delfyett**, *Regenerative multi-tone injection locking for linewidth enhancement and repetition rate stabilization of a PIC mode-locked laser*, IEEE Photonics Conference (IPC), Orlando, FL, MH4.2 (2017).
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- M.I. Akhlaghi and **A. Dogariu**, *Coherent noise reduction using heterodyne detection*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, SF2M.3 (2017).
- M.I. Akhlaghi and **A. Dogariu**, *Coherent noise suppression using interferometric cross-correlation*, Computational Optical Sensing and Imaging (COSI) San Francisco, California, CTu1B.3 (2017).
- M.I. Akhlaghi and **A. Dogariu**, *Compressive stochastic characterization of scattering media*, Computational Optical Sensing and Imaging (COSI) San Francisco, California, CM4B.3 (2017).
- J.R. Guzman-Sepulveda, J. Deng, J. Fang, and **A. Dogariu**, *Continuous characterization of viscoelasticity-modulated biopolymer hydrogels*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, ATu1A-5 (2017).
- F.A. Tan, R. Rezvani Naraghi, J. Kaufman, R. Wu, B. Davoudi, **A. Dogariu**, and **A.F. Abouraddy**, *Diffusive optical coatings loaded with multiscale composite microspheres produced from multimaterial fibers*, MRS Spring Meeting & Exhibit, SM2.4.03 (2017).
- M.I. Akhlaghi, L. Cilenti, A.S. Zervos, and **A. Dogariu**, *Dynamic biological systems characterization using non-stationary stochastic optical probe*, IEEE Photonics Conference (IPC), Orlando, FL, TuE2.4 (2017).
- J.R. Guzman-Sepulveda, J. Deng, J. Fang, and **A. Dogariu**, *Light scattering characterization of viscoelastic modulations in biopolymer hydrogels*, IEEE Photonics Conference (IPC), Orlando, FL (2017).
- Z. Shen, S. Sukhov, and **A. Dogariu**, *Monte carlo simulation of coherence propagation through scattering media*, Frontiers in Optics (FIO), Washington, D.C., FM3C.7 (2017).
- R. Rezvani Naraghi, L.G. Cançado, and **A. Dogariu**, *Near-field imaging with pseudo-thermal sources*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, FTh4H (2017).
- R. Rezvani Naraghi and **A. Dogariu**, *Phase transitions in the diffusion of light*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, FTu1G (2017).
- S. Cui, M.I. Akhlaghi, and **A. Dogariu**, *Quantitative phase imaging through encoding phase into the state of polarization*, IEEE Photonics Conference (IPC), Orlando, FL, WH3.4 (2017).
- M.I. Akhlaghi and **A. Dogariu**, *Tracking objects surrounded by scattering media*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, SF2M.1 (2017).
- M. Batarseh, Z. Shen, R. Rezvani Naraghi, H.E. Gamar, S. Sukhov, and **A. Dogariu**, *Transfer of complex spatial coherence function in reflection from inhomogeneous scattering media*, IEEE Photonics Conference (IPC), Orlando, FL, WP.37 (2017).
- M. Batarseh, Z. Shen, R. Rezvani Naraghi, H.E. Gamar, S. Sukhov, and **A. Dogariu**, *Transformation of complex spatial coherence function in reflection from random media*, Frontiers in Optics (FIO), Washington, D.C., JTu3A.86 (2017).
- H. Gamar, R. Rezvani Naraghi, M. Batarseh, A. Beckus, G. Atia, S. Sukhov, and **A. Dogariu**, *Wide-field interferometric measurement of nonstationary complex coherence function*, Frontiers in Optics (FIO), Washington, D.C., FTh3D.2 (2017).
- H. Gamar, R. Rezvani Naraghi, M. Batarseh, A. Beckus, G. Atia, S. Sukhov, and **A. Dogariu**, *Wide-field interferometric measurement of nonstationary complex coherence function*, IEEE Photonics Conference (IPC), Orlando, FL, WA1.3, WP.40 (2017).
- Y.J. Dong**, *20-1: Solution processable luminescent nanomaterials for display, lighting and beyond*, SID Symposium Digest of Technical Papers, 48(1), pp. 272-275 (2017). **Invited**
- Y.J. Dong**, *Quantum dot light emitting devices (QLEDs) as unique lighting solutions for photomedicine*, 11th International Nanotechnology/MEMS Seminar (INMS2017), Shizuoka University, Hamamatsu, Japan (2017).
- S. Fathpour** and J. Chiles, *All-silicon integrated photonic platforms*, IEEE International Conference on Electron Devices and Solid-State Circuits (EDSSC) 2017, Hsinchu, Taiwan, October 2017 (2017). **Invited**
- A. Rao, A. Patil, M. Malinowski, J. Chiles, S. Khan, A. Honardoost, S. Toroghi, G. F. Camacho-Gonzalez, P. Rabiei, and **S. Fathpour**, *Electro-optic and second-order nonlinear effects in thin film lithium niobate on silicon*, IEEE Photonics Society Summer Topicals Meeting Series 2017, San Juan, Puerto Rico) (2017). **Invited**
- S. Fathpour**, A. Rao, J. Chiles, S. Khan, P. Rabiei, S. Toroghi, M. Malinowski, A. Honardoost, and G.F. Camacho-Gonzalez, *Heterogeneous integration of lithium niobate on silicon substrates for electrooptic modulation and second-harmonic generation*, European Materials Research Society (EMRS) Spring Meeting, Strasbourg, France, May (2017). **Invited**
- A. Honardoost, A. Rao, and **S. Fathpour**, *High-speed modeling of thin-film lithium-niobate-on-silicon electrooptic modulators*, IEEE Photonics Society Summer Topicals Meeting Series 2017, San Juan, Puerto Rico, July 2017. (2017).
- A. Honardoost, A. Rao, and **S. Fathpour**, *High-speed modeling of thin-film lithium-niobate-on-silicon electrooptic modulators*, IEEE Photonics Society Summer Topical Meeting Series (SUM) (2017).
- J. Chiles, T. Sjaardema, A. Rao, and **S. Fathpour**, *Integrated Polarization Beam-Splitter with 116 THz Bandwidth via Topographically Anisotropic Photonics*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California (2017).
- T. Sjaardema, J. Chiles, A. Rao, and **S. Fathpour**, *Integrated polarization-selective microring resonators and beam taps via topographically anisotropic photonics*, IEEE Photonics Conference (IPC), Orlando, FL (2017).
- J. Chiles, X. Gai, B. Luther-Davies and **S. Fathpour**, *Mid-infrared supercontinuum generation in high-contrast, fusion-bonded silicon membrane waveguides*, IEEE Photonics Conference (IPC), Orlando, FL (2017).
- A. Rao, A. Patil, P. Rabiei, A. Honardoost, R. DeSalvo, A. Paoletta, and **S. Fathpour**, *Thin-film lithium niobate on silicon Mach-Zehnder electrooptic modulators up to 50 GHz*, Optical Fiber Communication Conference (OFC) (2017).
- R.M. Gaume**, *Monitoring the fabrication of optical ceramics by LIBS*, 9th International Conference on High Temperature Ceramic Matrix Composites and Global Forum on Advanced Materials and Technologies for Sustainable Development (ACeS conference), Toronto Ontario, Canada, June (2017). **Invited**
- R.M. Gaume**, *Phase change sintering*, ICACC'17 conference, Daytona FL, USA, January, 24 (2017).
- G. Tao, F. A. Tan, S. Chen, **R.M. Gaume**, **A.F. Abouraddy**, *Thermally drawn, electrically conductive glass fibers*, MRS Spring Meeting & Exhibit, SM2.3.03 (2017).
- F. Kompan, I. Divliansky, V. Smirnov, **L.B. Glebov**, *Complex holographic elements in photo-thermo-refractive glass for the visible spectral region*, CREOL Affiliates Symposium (2017).
- F. Kompan, I. Divliansky, V. Smirnov, and **L.B. Glebov**, *Complex holographic elements in photo-thermo-refractive glass for the visible spectral region*, 12th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 12), including Glass & Optical Materials Division Meeting (GOMD), Kona, Hawaii (2017). **Invited**
- L.B. Glebov**, *High brightness diode lasers controlled by volume Bragg gratings*, SPIE Photonics West, San Francisco, California, 1012319, 1-8 (2017).
- L.B. Glebov**, *High brightness diode lasers controlled by volume Bragg gratings*, Novel In-Plane Semiconductor Lasers XVI, Proc. of SPIE, 10123 (2017).
- C. J. Magon, J. P. D. Gonzalez, J. F. Lima, H. Eckert, E. D. Zanutto, H. Mingareev, F. Kompan, L. Glebova, and **L.B. Glebov**, *Mechanism of photoionization of photo-thermo-refractive glass*, 12th Pacific Rim Conference on Ceramic and Glass Technology (PACRIM 12), including Glass & Optical Materials Division Meeting (GOMD), Kona, Hawaii (2017).

- L.B. Glebov**, *Photosensitivity of doped and undoped silicate glasses*, XI Brazilian Symposium on Glass and Related Materials. Curitiba, Brazil (2017).
- L.B. Glebov**, *Volume holographic elements in photo-thermo-refractive glass: features and applications*, Frontiers of Glass Technology Award Lecture (2017).
- S. Benis, **D.J. Hagan**, and **E.W. Van Stryland**, *Cross-propagating beam-deflection measurements of third-order nonlinear optical susceptibility*, Nonlinear Frequency Generation and Conversion: Materials and Devices XVI, Proceedings of SPIE, 10088 (2017).
- D.J. Hagan**, H.S. Pattanaik, P. Zhao, M. Reichert, and **E.W. Van Stryland**, *Extremely nondegenerate two-photon processes in semiconductors*, 5th International Conference on Photonics, Optics, and Laser Technology, pp.65-69 (2017).
- D.J. Hagan**, M. Reichert, P. Zhao, H.S. Pattanaik, and **E.W. Van Stryland**, *Nondegenerate nonlinear refraction, absorption, and gain in semiconductors*, SPIE Ultrafast Bandgap Photonics 3SPIE DCS conference, Anaheim, April 15 - 19 (2017).
- S. Benis, P. Zhao, **D.J. Hagan**, and **E.W. Van Stryland**, *Nondegenerate, transient nonlinear refraction of indium tin oxide at epsilon-near-zero*, Nonlinear Optics 2017, Waikoloa, Hawaii, NW1A.3. (2017).
- S. Benis, P. Zhao, H. Pattanaik, **D.J. Hagan**, and **E.W. Van Stryland**, *Time-resolved nonlinear refraction of indium tin oxide at epsilon near zero*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California (2017).
- J. Donnelly, S. Castillo, W. Chemnasiri, and **F.E. Hernandez**, *Determination of the overall antioxidant strength of teas combining metal nanoparticles, plasmonics, and fluorescence: Designing new experiments for the physical chemistry laboratory*, 253rd ACS Annual Meeting, San Francisco, California (2017).
- D. Donnelly and **F.E. Hernandez**, *SoTL in an upper-level undergraduate STEM course fusing a reversed learning scheme with an informal learning space*, Sunshine State Teaching and Learning Conference: teaching in the 21st Century, St. Pete Beach, Florida (2017).
- E. Romero, J. Dipold, **F.E. Hernandez**, *Synchronized double pump-probe technique for polarization dependent time-resolved chiral spectroscopy*, IEEE Photonics Conference (IPC), Orlando, FL (2017).
- J. Donnelly and **F.E. Hernandez**, *Two-photon absorption spectroscopy on curcumin in solution: A state-of-the-art physical chemistry experiment*, 253rd ACS Annual Meeting, San Francisco, California (2017).
- C. Jin, **B. Huang**, H.S. Chen, N.K. Fontaine, R. Ryf, R.J. Essiambre, B. Ung, Y. Messaddeq, and S. LaRochelle, *Investigation of inter-core cross-talk in cladding pumped double-clad 6-core erbium doped fiber amplifier*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, STu1F.7 (2017).
- E. Castillo-Orozco, **A. Kar**, and R. Kumar, *Electrospray mode transition of microdroplets for high conductivity nanoparticle suspension*, 2nd International Conference of Interfacial Phenomena and Heat Transfer (IPHT 2017), Xi'an, China, July 7-10 (2017).
- G. Lim, T. Manzu, and **A. Kar**, *MWIR uncooled SiC detector with optical signal output*, SPIE 10184, Surveillance, Nav Systems, and Technologies I, Defence & Commercial Sensing, Anaheim California, April 11-13 (2017).
- E. Castillo-Orozco, **A. Kar**, and R. Kumar, *Nanoparticle electrospray laser deposition for additive manufacturing of microlayers on flexible substrates*, International Microelectronics Assembly and Packaging Society (IMAPS), Florida Chapter, Advanced Technical Workshop: Smart Sensors, Research, Manufacturing and IoT Applications, Orlando. (2017).
- E. Castillo-Orozco, **A. Kar**, and R. Kumar, *Superlens-focused laser electrospray microprocessing of nanoparticles*, International Congress on Applications of Lasers and Electro-Optics (ICALEO), Atlanta, Georgia (2017).
- A. Kar** and N. R. Quick, *Transformation of gaussian beams into m-beams for advanced microvia drilling*, Laser Ablation for Microelectronics, Laser Microprocessing Conference, Laser Institute of America, International Congress on Applications of Lasers and Electro-Optics (ICALEO), Atlanta, GA. (2017).
- M. Khajavikhan**, *Active parity-time symmetric systems*, SPIE Optics and Photonics Conference, San Diego, CA 2017 (2017).
- M. Khajavikhan**, and **D.N. Christodoulides**, *Active parity-time symmetric systems*, Active Photonic Platforms IX, Vol. 10345, pp. 1034521 (2017).
- M. Khajavikhan**, *Advances in Microscale Parity-time-symmetric Lasers*, Frontiers in Optics (FIO), Washington, D.C. (2017).
- M. Khajavikhan**, *Collective behaviors in arrays of coupled nanolasers*, IEEE Summer Topicals, San Juan, Puerto Rico (2017).
- M. Khajavikhan**, *Parity-time-symmetric photonics: optics at an exceptional point*, The 24th Congress of the International Commission for Optics (2017).
- M. Khajavikhan**, *Photonics molecules with enhanced sensitivity at higher order exceptional points*, SPIE Nanophotonics Australasia, Melbourne, Australia (2017).
- A.U. Hassan, B. Zhen, M. Soljagic, **M. Khajavikhan**, and **D.N. Christodoulides**, *Polarization state conversion through exceptional point encirclement*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, FTh3D.1 (2017).
- M. Khajavikhan**, *PT-symmetric lasers*, SPIE Optics and Photonics Conference San Diego 2017 (2017).
- M. Parto, H. E. Lopez Aviles, **M. Khajavikhan**, **R. Amezcua-Correa**, and **D.N. Christodoulides**, *Topological Aharonov-Bohm suppression of optical tunneling in twisted nonlinear multicore fibers*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, FTh1D.4 (2017).
- M. Segev, G. Harari, M. Bandres, S. Wittek, H. Hodaei, Y. Lumer, M. Rechtsman, **M. Khajavikhan**, Y. Chong, D. Christodoulides, *Topological insulator lasers*, IEEE Photonics Conference (IPC), Orlando, FL, TuC3.1 (2017).
- S.M. Kuebler**, R. Sharma, J. Digaum N. Martinez, C. L. Valle, R.C. Rumpf, *Nanophotonic devices for three-dimensional control of optical beams*, Frontiers in Optics (FIO), Washington, D.C., FM3D.5 (2017).
- J.M. Kahn, **G.F. Li**, X. Li, and N.B. Zhao, *Capacity limits for free-space channels*, Optical Fiber Communication Conference and Exhibition (OFC), Los Angeles, California (2017).
- J.M. Kahn, **G.F. Li**, X. Li, and N. Zhao, *Capacity limits for spatially multiplexed free-space communication*, Optical Fiber Communication Conference and Exhibition (OFC), Los Angeles, California, W1B.3 (2017).
- G.F. Li**, Y. Bromberg, B. Redding, S. Popoff, N. Zhao, and H. Cao, *Classical key distribution in optical communication*, SPIE 10130, Next-Generation Optical Communication: Components, Sub-Systems, and Systems VI (2017).
- G.F. Li**, Y. Bromberg, B. Redding, S. Popoff, N. Zhao, and H. Cao, *Classical key distribution in optical communication*, SPIE 10130, Next-Generation Optical Communication: Components, Sub-Systems, and Systems VI (2017).
- C. Guo, Z. Zhang, N. Zhao, L. Zhang, X. Li, and **G.F. Li**, *Design of elliptical-core few-mode fibers for optical parametric amplification*, Optical Fiber Communication Conference and Exhibition (OFC), Los Angeles, California, W2A.20 (2017).
- H. Tian, L.C. Kimerling, J. Michel, **G.F. Li**, and L. Zhang, *Multipath trapping dynamics of nanoparticles towards an integrated waveguide with a high index contrast*, Microfluids, Biomems, and Medical Microsystems XV, Proceedings of SPIE, 10061 (2017).
- R. Mi, N. Zhao, Z. Yang, L. Zhang, and **G.F. Li**, *Simultaneous measurement of chromatic and modal dispersion in FMFs using microwave photonic techniques*, Optical Fiber Communication Conference and Exhibition (OFC), Los Angeles, California, Th2A.48 (2017).
- L. Yu, J. Zhao, Q. Mo, L. Zhang, and **G.F. Li**, *Simultaneous measurement of temperature and strain based on a polarization-maintaining few-mode fiber*, Optical Fiber Communication Conference and Exhibition (OFC), Los Angeles, California, Paper W3H.6 (2017).
- T. Tabbakh and **P.L. LiKamWa**, *Blue and red shifted, partially intermixed ingaasp quantum well semiconductor laser diodes*, IEEE Photonics Conference (IPC), Orlando, FL, 113-114 (2017).
- W. Hayenga, M. Parto, H. Hodaei, **P.L. LiKamWa**, **D.N. Christodoulides**, and **M. Khajavikhan**, *Coupled metallic nanolaser arrays*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California, FTu3H.7 (2017).
- M. Torres-Cisneros, **P.L. LiKamWa**, R. Guzman-Cabrera, D. May-Arrioja, A.L. Herrera-May, and M. Gomez-Sarabia, *Fabrication of micro-optical magnetic sensor*, Photonics North, 1-1 (2017).
- T. Tabbakh, **P.L. LiKamWa**, *Quantum well intermixed tunable wavelength single stripe laser diode*, SPIE 10345, Active Photonic Platforms IX, 1034504 (2017).

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P. Figueiredo, M. Suttinger, R. Go, A. Todi, H. Shu, E. Tsvi, C.K.N. Patel, **A. Lyakh**, *High performance 40-stage and 15-stage quantum cascade lasers based on two-material active region composition*, Micro-and Nanotechnology Sensors, Systems, and Applications IX (2017).

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X. Yuan, Y. Sun, and **S. Pang**, *Compressive temporal RGB-D imaging*, OSA Imaging and Applied Optics Congress, San Francisco, California (2017).

Z. Zhu and **S. Pang**, *Full three-dimensional direction-dependent X-ray scattering tomography*, Medical Imaging 2017: Physics of Medical Imaging, Proceedings of SPIE, 10132 (2017).

S. Pang and Z. Zhu, *Interior tomographic imaging for x-ray coherent scattering*, Anomaly Detection and Imaging with X-Rays (ADIX) II, Proceedings of SPIE, 10187 (2017).

X. Yuan and **S. Pang**, *Video compressed imaging using side information (Rising Researcher Paper)*, SPIE Defense & Commercial Sensing, Anaheim California, April 9 - 13 (2017).

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X. Ren, *53-attosecond X-ray pulses glancing through the water window*, Conference on Lasers and Electro-Optics (CLEO), San Jose, California (2017).

J. Kassel, Z. Ma and **C.K. Renshaw**, *A vertically-stacked anti-polar diode (VAD) pixel for organic semiconductor image sensors*, IEEE Photonics Conference (IPC), Orlando, FL (2017).

Z. Ma and **C.K. Renshaw**, *Hemispherical focal plane arrays for wide field-of-view imaging*, SPIE 10209, Image Sensing Technologies: Materials, Devices, Systems, and Applications IV, 102090F (2017).

Z. Ma, X. Wang, H. J. Cho and **C.K. Renshaw**, *Nonplanar focal plane with silicon based photodetectors*, IEEE Photonics Conference (IPC), Orlando, FL (2017).

M. Malinowski, J.-E. Tremblay, G.F.C. Gonzalez, A. Rao, S. Khan, A. Yadav, **K.A. Richardson**, **P.J. Delfyett**, M.C. Wu and **S. Fathpour**, *Amplified octave-spanning supercontinuum chalcogenide waveguides for second-harmonic generation*, IEEE Photonics Conference (IPC), Orlando, FL (2017).

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J. Li, G. Yin, J. Michon, Y. Huang, Q. Du, L. Li, H. Lin, A. Agarwal, A. Yadav, **K.A. Richardson**, J. Hu, *Chalcogenide glass and glass ceramics for integrated photonics*, 41st International Conference and Exposition on Advanced Ceramics and Composites (ICACC), Daytona Beach Florida, ICACC-S14-001-2017 (2017).

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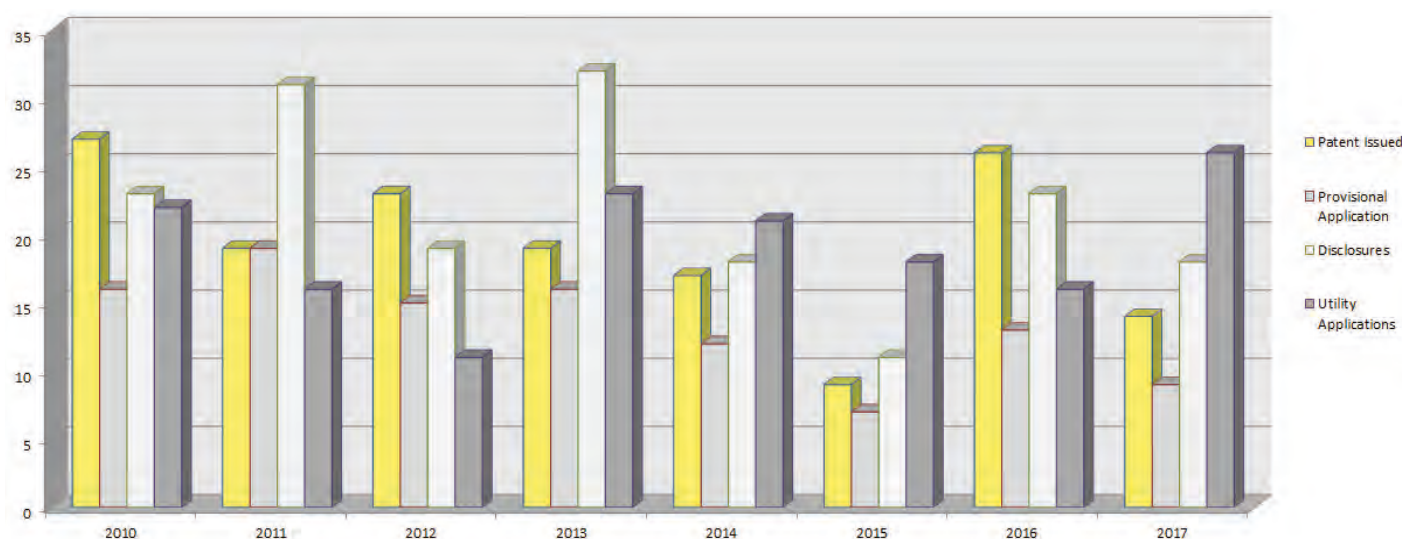
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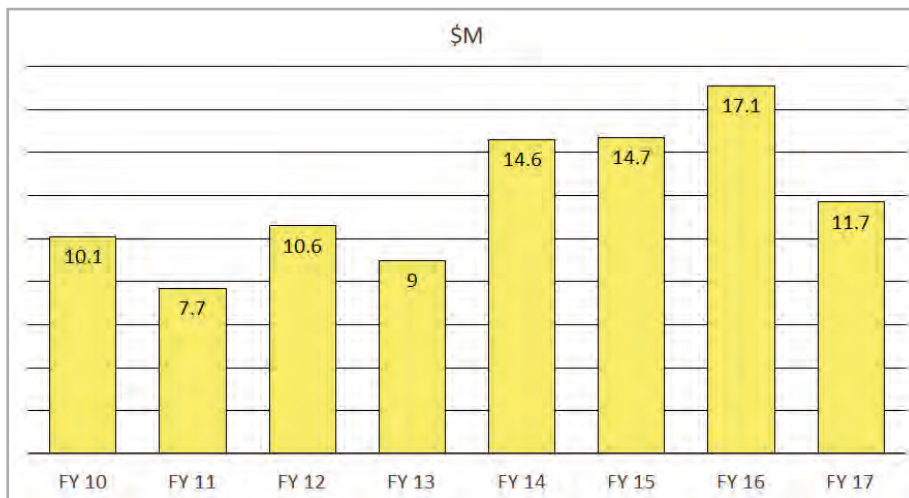
HISTORY OF DISCLOSURES, APPLICATIONS AND ISSUED PATENTS BY FISCAL YEAR.



RESEARCH FUNDING

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Federal	\$9,800,973
Federal through Industry	\$637,385
Industry R&D	\$633,158
International	\$529,991
Foundation	\$123,395
TOTAL	\$11,724,902



RECEPIENT	SOURCE	TITLE OF AWARD	BEGIN	END	AWARDED
PI: Abouraddy, A.	Massachusetts Institute of Technology	Harnessing in-fiber fluid instabilities for scalable and universal multidimensional nanosphere design, manufacturing, and applications	12/1/2014	10/31/2018	\$91,510
PI: Abouraddy, A.	Lambda Photonics	Robust Mid-IR Optical Fibers for Extreme Environments	10/11/2016	1/14/2017	\$75,000
PI: Abouraddy, A.; CoPI: Atia	Office of Naval Research	Development of Diffraction-Free Space-Time Optical Beams	7/17/2017	6/30/2018	\$42,936
PI: Abouraddy, A.; CoPI: Li. Bai	Harris Corporation	Strong Ultra-Small Highly Integrated (SUSHI) Phase 2 Fiber Optic Cable (Prime 1)	4/3/2017	6/30/2018	\$349,076
PI: Amezcua Correa, R.	Harris Corporation	Application of Photonic Lantern Technology for RF Photonics and Telecom Applications	3/1/2017	11/29/2017	\$25,000
PI: Amezcua Correa, R.; CoPI: Glebov, Richardson, M., Schülzgen, A. Shah, L.	US Army Research Office	Fiber Laser Light Engines - A New Platform to Collectively Address Power-limiting Constraints	8/20/2012	8/19/2020	\$500,000
PI: Amezcua Correa, R.; CoPI: Schülzgen, A.	"US Army Research Office Federal/DoD/Army"	High Purity Gas Control System for MCVD Optical Fiber Preform Manufacturing	7/6/2016	7/5/2018	\$106,329
PI: Amezcua Correa, R.; CoPI: Schülzgen, A.	SA Photonics	Negative Curvature Hollow Core Optical Fiber	6/28/2017	4/20/2018	\$39,984
PI: Amezcua Correa, R.; CoPI: Schülzgen, A.	Saint Gobain	Scintillating Fiber	6/16/2017	11/30/2017	\$13,918
PI: Baudalet; CoPI: Richardson, M	Yale University	UV-Vis Microcombs Based on EC-cut (Al,Ga)N	9/22/2015	9/21/2017	\$23,386

PI: Chang, Z.	Defense Advanced Research Projects Agency (DARPA)	Microjoule-level isolated attosecond pulses for atto pump-atto probe	7/25/2013	7/24/2018	\$438,802
PI: Chang, Z.	The Regents of The University of California	Post-Born-Oppenheimer Dynamics Using Isolated Attosecond Pulses	7/21/2014	1/20/2018	\$0
PI: Chang, Z.	US Air Force Office of Scientific Research (AFOSR)	Studying Ultrafast Electron Dynamics in Condensed Matter with Next Generation Attosecond X-ray Sources	12/15/2014	12/14/2017	\$551,250
PI: Chernyak, L.; CoPI: Gaume, G., Flitsiyank, Kik, Kolpashchikov	National Science Foundation (NSF)	MRI: Acquisition of a Cathodoluminescence Microscope for Device Testing, Materials Research and Education	9/1/2016	8/31/2018	\$270,900
PI: Christodoulides, D. N.	Lockheed Martin Missiles and Fire Control	Advanced Optical Filters and Coatings	4/1/2016	2/28/2017	\$25,000
PI: Christodoulides, D.N.	Pennsylvania State University	MRSEC - Center for Nanoscale Science	11/1/2014	10/31/2018	\$60,000
PI: Christodoulides, D.N.	The Texas A&M University System	Self-generated spatiotemporal nanostructuring of laser light applied to energy transport and reconfigurable guiding networks in nanophotonics, plasmonic, and hybrid nanoparticles metacolloids	12/13/2016	7/1/2019	\$57,997
PI: Christodoulides, D.N.; CoPI: Abouraddy	US Air Force Office of Scientific Research (AFOSR)	MURI: PT-Symmetric Optical Materials and Structures	10/15/2013	4/14/2018	\$1,932,232
PI: Crabbs, R.F.	Aegis Technologies Group, Inc.	ARI: Testing at SLF	3/9/2017	8/31/2017	\$25,200
PI: Crabbs, R.F.	Office of Naval Research	Atmospheric Propagation for High Energy Lasers, Supporting APSHEL Program	1/1/2017	12/31/2019	\$1,065,484
PI: Crabbs, R.F.	University of Maryland/College Park	Optical Turbulence Instrumentation (Option Years from 65018465)	6/1/2016	5/31/2017	\$354,065
PI: Crabbs, R.F.; CoPI: Delfyett	Various	RF: Tracker System	7/1/2016	6/30/2020	\$5,000
PI: Delfyett, P.J.; CoPI: Fathpour	University of California at Berkeley	Heterogeneously Integrated Optical Synthesizer (H-iOS)	3/31/2015	12/30/2017	\$642,319
PI: Deppe, D.G.	University of Texas at Austin	Research and Development of Nanocavity Lasers for Integration with Single Mode Silicon Waveguides	12/1/2016	11/30/2019	\$81,969
PI: Deppe, D.G.	US Army Research Office	Scalable High Speed Laser Diode for Silicon Integration	10/1/2015	11/30/2017	\$140,000
PI: Divliansky, I.	OptiGrate Corporation	High efficiency uniform nonplanar holographic optical elements in photo-thermo-refractive glass	10/1/2016	3/30/2017	\$24,000

PI: Divliansky, I.	OptiGrate Corpora- tion	Large-aperture single-transverse-mode ultrashort pulsed laser	7/15/2016	1/11/2017	\$24,000
PI: Dogariu, A.	Sherwin Williams Company	Modeling of Pigment Clusters in Paint Formula- tions	2/1/2017	1/31/2018	\$97,581
PI: Fathpour, S.	Northwestern Uni- versity	Integrated Optics for Single-Photon Nonlinear Interactions	6/1/2017	5/31/2018	\$18,300
PI: Fathpour, S.	Partow Technologies, LLC	Thin film lithium niobate microring modulators for analog photonics	7/13/2016	7/9/2017	\$9,009
PI: Glebov, L.B.	OptiGrate Corpora- tion	Laser diode array with diffraction limited diver- gence	12/1/2016	5/21/2017	\$30,000
PI: Hagan, D.J.	University of Michi- gan	Measurement of Magneto-Electric Susceptibilities	12/1/2015	7/14/2018	\$49,145
PI: Hagan, D.J.; CoPI: Van Stryland	US Army Research Laboratory	Characterization of Novel Nonlinear Optical Materials	7/27/2015	9/28/2018	\$200,000
PI: Hagan, D.J.; CoPI: Van Stryland	National Science Foundation (NSF)	OP: Semiconductor materials for extremely non- degenerate photonics and 2-photon gain	8/15/2016	7/31/2019	\$415,226
PI: Katsevich, A.; CoPI: Pang, Tovbis	National Science Foundation (NSF)	Hilbert transform with incomplete data and ap- plications in Tomography and Optics	9/1/2016	8/31/2019	\$83,750
PI: Khajavikhan, M.	Office of Naval Re- search	YIP: Parity-Time (PT) Symmetric Photonics	6/1/2016	5/31/2019	\$255,000
PI: Khajavikhan, M.; CoPI: LiKamWa	US Army Research Office	Design fabrication and characterization of Electri- cally Pumped Coaxial Nanoscale Lasers	11/16/2015	11/15/2017	\$150,000
PI: Kik, P.G.	National Science Foundation (NSF)	EAGER: Directed Total Internal Reflection Devices	9/1/2016	2/28/2018	\$140,024
PI: Kuebler, S.M.	Academy of Applied Science	High School Summer Research Experience in the Kuebler-Group at UCF with the REAP/AEOP Program	5/1/2016	9/30/2017	\$750
PI: Kuebler, S.M.; CoPI: Fathpour	National Science Foundation (NSF)	Collaborative Research: Photon Funnels – A Fun- damentally New Concept for Concentrating Light	7/15/2017	6/30/2020	\$98,003

PI: Li, G.	Futurewei Technologies, Inc.	Fundamental research on few-mode fiber optical transmission	11/16/2016	11/15/2018	\$479,991
PI: Mingareev, H.	OptiGrate Corporation	Barium Silicate Glass Services	3/31/2017	5/15/2017	\$15,000
PI: Richardson, K.A.	Lockheed Martin Missiles and Fire Control	Advanced Materials IRAD - Broadband Gradient Index (GRIN) Optics	3/3/2017	12/22/2017	\$45,000
PI: Richardson, K.A.	Semplastics, LLC.	Large-Scale Molded Silicon Oxycarbide Composite Components for Ultra-Low-Cost Lightweight Mirrors	7/1/2016	4/24/2018	\$100,000
PI: Richardson, K.A.	Various	RF K. Richardson Equipment Use Account	1/1/2015	12/31/2018	\$40,444
PI: Richardson, K.A.	Massachusetts Institute of Technology	Uncooled Chipscale Mid-infrared Photothermal Sensor for Ultra-sensitive Chemical Detection	8/1/2015	7/31/2018	\$50,000
PI: Richardson, K.A.	Lockheed Martin Missiles and Fire Control	Visible/SWIR Gradient Index (GRIN) Optics	2/1/2017	11/1/2017	\$25,000
PI: Richardson, K.A.; CoPI: Kuebler	Lockheed Martin Missiles and Fire Control	Broadband Gradient Index (GRIN) Optics Phase 3	12/14/2015	12/31/2016	\$14,540
PI: Richardson, M.C.	US Army Research Office	DURIP: LWIR picosecond source for Ultra-short High Intensity CO2 Laser	4/15/2017	4/14/2018	\$55,363
PI: Richardson, M.C.	US Army Research Office	Light Filamentation Science Add on (Topological photonic structures based on light filamentation)	5/20/2016	10/31/2018	\$8,297
PI: Richardson, M.C.; CoPI: Amezcua Correa, Schülzgen, Shah	US Air Force Office of Scientific Research (AFOSR)	Fundamental Fiber Laser Science for High Powers	8/1/2015	4/30/2018	\$1,261,957
PI: Saleh, B.	UCF Foundation, Inc	CREOL - UCF Foundation Gifts	7/1/2014	6/30/2018	\$122,645
PI: Schepler, K.; CoPI: Abouraddy, Shah	Lockheed Martin Corporation	ARI: Evaluation of the optical and mechanical properties of chalcogenide fiber	8/29/2016	6/30/2017	\$75,000
PI: Schoenfeld, W.V.	US Photovoltaic Manufacturing Consortium, Inc (PVMC)	PV Manufacturing Consortium	5/1/2016	4/30/2017	\$121,691

PI: Shah, L.	Lasera LLC	Trans-wafer laser packaging technology for sensitive MEMS devices	1/18/2017	6/8/2017	\$26,300
PI: Vodopyanov, K.L.	Defense Advanced Research Projects Agency (DARPA)	Ultra-compact comb source with instantaneous bandwidth of 3 - 10 μm for massively parallel spectroscopic sensing	6/9/2015	9/22/2018	\$300,000
PI: Vodopyanov, K.L.; CoPI: Gaume	Office of Naval Research	Ultra broadband mid-infrared frequency combs from transparent ZnSe ceramics	7/1/2015	9/30/2018	\$171,528
PI: Webster, S.	Raytheon Company	Comparison of Yb:YAG and Nd:YAG single crystals and ceramic samples	11/1/2016	8/31/2017	\$15,000
PI: Wu, S.T.	Intel Corporate Research Council	Fast-response liquid crystal devices for light field displays	11/15/2016	11/14/2017	\$75,000
PI: Wu, S.T.	Industrial Technology Research Institute (ITRI)	Optics for transparent OLEDs and high efficiency OLEDs	1/1/2017	12/31/2017	\$50,000
PI: Wu, S.T.	US Air Force Office of Scientific Research (AFOSR)	Submillisecond-response liquid crystal spatial light modulators	9/1/2014	8/31/2018	\$160,000

2017 LUMINARY HONOREES FROM CREOL



AYMAN ABOURADDY

Abouraddy is helping to revolutionize the way we use clothing by working with fellow researchers at MIT to weave optical fibers into textiles. That could mean clothes that conceivably conduct electricity, sense temperature and body functions, communicate with the Internet, and report injuries to soldiers on the battlefield. His multi-material optical fiber devices play a critical role in a \$317 million Department of Defense collaboration.



ZENGHU CHANG

Pegasus Professor Chang loves a challenge. He and his team produced the shortest-ever laser pulse in 2012, a 67-attosecond X-ray flash. Then in 2017, he beat his own record, creating a laser pulse of 53 attoseconds. For the non-physicists in the room, he's essentially developing technology to shoot slow-motion video of electrons and how they interact with atoms. That would open up the world of quantum mechanics to us, and help us leap ahead in the development of the next-generation logic boards and memory chips for mobile phones and computers.



DEMETRIOS CHRISTODOULIDES

Christodoulides' work in optics focuses on nonlinear waves. He has authored and co-authored more than 250 papers. His expertise has earned him multiple awards and recognitions, including being named Pegasus Professor in 2013. He is a Fellow of the Optical Society of America and the American Physical Society. He also has been named Thompson Reuters Highly Cited Researcher for two years running, and he is listed among "The World's Most Influential Scientific Minds."

AFFILIATED RESEARCH CENTERS

The University of Central Florida has several nationally and internationally recognized research institutes in addition to the three at CREOL, The College of Optics and Photonics that are devoted to research and development.

Advanced Materials Processing and Analysis Center

The Advanced Materials Processing and Analysis Center (AMPAC) is an interdisciplinary research and education center for materials science and engineering, one of two major UCF research centers that comprise the Center of Advanced Materials and Nanotechnology. Our two university-wide multi-user facilities — the Materials Characterization Facility (MCF) and the Advanced Microfabrication Facility (AMF) - are available to all researchers at UCF and from outside companies, government labs, and universities, enabling them to perform cutting-edge research, and to train and educate students and other personnel in the use of state-of-the-art equipment. AMPAC's vision is to make UCF an international leader in materials science and engineering research and education by excelling in the development, processing and characterization of advanced materials to achieve prominence in targeted research areas; providing leadership to the UCF Materials Science and Engineering research and education program; and enhancing economic growth and promoting industrial development through effective partnerships with industry.

NanoScience Technology Center

In 2004 the Nanoscience Technology Center (NSTC) was formed with formed with a \$4M grant from the state of Florida when leaders recognized the potential of nanotechnology as its applications in medicine, materials, computing and electronics began entering the mainstream. Since that time, NSTC has consolidated UCF researchers across multiple disciplines and hired many more to better respond to nanoscience funding opportunities and to develop the technologies demanded by the industries of the future. In 2007 the NSTC officially opened a 20,000- square-foot renovated research facility in the Central Florida Research Park. A total of 19 faculty, 7 staff and more than hundred graduate students, postdocs, researchers at the center are creating tools to treat neurological diseases; materials that can advance solar and fuel cell technology; and longer batteries that can make ever-smaller electrical devices a reality. Current research areas include Green Energy, In Vitro Test Systems, Functional Nanomaterials, Computer/Mathematical Simulations, Quantum Dynamics, Nano-Bio-Imaging, NanoElectronics & NanoPhysics, and Integrated Device Development.

Burnett School of Biomedical Sciences

The Burnett School of Biomedical Sciences is an integral part of the UCF College of Medicine, making the college a research-intensive medical school where cutting edge medical research spans the entire spectrum from laboratory bench to bedside of the patients, providing a great environment of training physicians and biomedical researchers. The School's mission is to provide quality undergraduate and graduate programs in the biomedical sciences and build excellent research programs focused on cancer, cardiovascular, neurodegenerative diseases, and infectious diseases. Our faculty are working to take science from the bench to the bedside. In addition to conducting cutting edge research in biomedicine with potential application to curing major diseases, the School is committed to helping to develop a technology-based industry in Florida. Active partnerships formed with other units at UCF such as the College of Optics and Photonics, the School of Electrical Engineering and Computer Science and the NanoScience

Technology Center will facilitate interdisciplinary research and education programs in the innovative applications of photonics, bioinformatics and nanoscience to biomedical problems. The School offers three BS degree programs: Biomedical Sciences; Biotechnology; and Medical Laboratory Sciences. Graduate programs include the MS Biomedical Sciences (non-thesis), the MS Program in Biotechnology (thesis), and a new MS Professional Science in Biotechnology. The interdisciplinary Ph.D. and MD-Ph.D. programs in Biomedical Sciences prepare tomorrow's biomedical research scientists.

Florida Solar Energy Center



The Florida Solar Energy Center® (FSEC®) is the largest and most active state-supported energy research institute in the United States. Located on the Cocoa campus of UCF at Eastern Florida State College, FSEC has gained national and international respect for its programs on photovoltaics, solar thermal systems, energy-efficient buildings, advanced cooling technologies, hydrogen and fuel cells, and the testing and certification of solar equipment. The Center conducts continuing education workshops for professionals, government and industry leaders around the world. Additionally, FSEC offers Science, Technology, Engineering and Mathematics (STEM)-focused opportunities to K-12 and college level-students, professional development for teachers, and renewable energy curriculum and activities to schools throughout Florida.

Florida Space Institute

The Florida Space Institute (FSI) supports space research, development, and education activities. In addition, FSI supports the development of Florida's space economy—civil, defense, and commercial.

Since 1996, FSI has been an institute of the State University System of Florida. FSI is made up of researchers, educators, and staff from various science and engineering departments at the University of Central Florida. FSI research ranges from studying the Earth's upper atmosphere to the origin of the planets and from the workings of asteroids to propulsion technologies for high-Mach aerospace vehicles.

FSI is involved in space missions as diverse as high altitude rocket launches, next-gen suborbital flights, the NASA Cassini mission to Saturn, and NASA's Explorer program. In addition,

one FSI faculty is the Principal Investigator for the Global-scale Observations of the Limb and Disk (GOLD) project which was recently awarded a \$55 million grant from NASA. This grant makes UCF the first university in Florida to lead a satellite mission for NASA. The Center for Lunar and Asteroid Surface Science (CLASS), a NASA sponsored Center, is also housed at FSI and the Physics department. FSI administratively houses the Florida Space Grant Consortium (FSGC) for NASA, and operates the Space Research Initiative (SRI) for the State of Florida.

Institute for Simulation and Training

IST is an internationally recognized research institute that focuses on advancing modeling and simulation technology and increasing our understanding of simulation's role in training and education. Founded in 1982 as a research unit of the University of Central Florida, the institute provides a wide range of research and information services for the modeling, simulation and training community. Faculty and staff are distributed among IST's three Central Florida Research Park buildings, Partnership II, Partnership III and the Army Research Laboratory Simulation and Training Technology Center (ARL-STTC).

Center for Research in Computer Vision

The common goal and purpose of the center is to strongly promote basic research in computer vision and its applications in all related areas including National Defense & Intelligence, Homeland Security, Environment Monitoring, Life Sciences and Biotechnology and Robotics. Computer vision is the science of electronically acquiring, analyzing and understanding images in ways superior to the human brain. The CRCV is directed by Dr. Mubarak Shah of the Department of Electrical Engineering and Computer Science. Shah is also an affiliate faculty member at CREOL.

Other Facilities & Centers

Other organized programs at UCF offer researchers and students additional support in pursuit of their research goals. These include:

- ▲ National Center for Simulation (NCS)
- ▲ Center for Advanced Transportation Systems Simulation (CATSS)
- ▲ National Center for Forensic Science (NCFS)
- ▲ Small Business Development Center (SBDC)
- ▲ University of Central Florida Business Incubation Program (UCFBIP)

BRIDG



BRIDG is a Florida not-for-profit industry-led smart sensor consortium founded by Osceola County, UCF, and the Florida High Tech Corridor Council, with the goal of accelerating technology commercialization by bridging technology and capability gaps across multiple fields. BRIDG is focused on manufacturing development of advanced technologies in smart sensors, imagers, advanced devices, 2.5D/3D chip integration, and photonic devices. Service areas include research, development, and commercialization. BRIDG is located in Osceola County, FL, in a new 109,000 square foot facility inaugurated in March 2017. The facility includes approximately 40,000 square feet of cleanroom laboratory/manufacturing space.



Facilities and equipment in the Optical Materials Laboratory

PARTNERSHIP AND OUTREACH

Since its early years, the College has benefitted from a strong partnership with industry. It endeavors to transfer the technology developed by the faculty, scientists, and students to industry, particularly Florida industry, and to assist in forming, recruiting, and retaining optics and optics-related industries in Florida. The College has established a large industrial affiliates program (with current membership of 63 companies, sustained over many years). Our Industrial Affiliates Day brings in optics companies from around the country to learn about the ongoing research, recruit students, and identify new partnering opportunities.



INDUSTRIAL AFFILIATES PROGRAM

Membership in the Industrial Affiliates (IA) program provides to industrial corporations, organizations, and individuals many benefits, most of which are also of mutual benefit to CREOL. One of these mutual benefits is the regular communication and contact the program provides between the research faculty and students at the College and the IA member company's engineers and scientists who are developing new technologies and products for their business. Other benefits include:

- ▲ Establishing a close association with this leading institute in optics, lasers, and photonics
- ▲ Exposure to the latest research and developments in cutting edge technologies
- ▲ Membership certificate or plaque for display in your facility
- ▲ Availability of sophisticated measurement, test, and calibration facilities
- ▲ Early notice of students approaching graduation (the next generation of experts in the field). See our Student Resumes.
- ▲ Ability to post your job openings on our website (exclusive benefit for IA members)
- ▲ Close interactions with our faculty, each of whom are leaders in their fields
- ▲ Opportunity to make presentations about your company and products to the faculty and students of the College
- ▲ Opportunity to participate in our Industrial Advisory Board, a committee of our senior stakeholders that provides advice on the long-term direction of CREOL, The College of Optics & Photonics
- ▲ Copies of the College's periodic newsletter, Highlights, and monthly e-Highlights
- ▲ Notification of seminars at the College
- ▲ Opportunity for free presentation space at our annual Industrial Affiliates Day meeting
- ▲ Several Web-based benefits, including linkage to your company's web site from the College website
- ▲ For companies who donate equipment, getting their hardware/software in the hands of some of the leading researchers – faculty and students – in the field provides visibility to future customer prospects and information on its impact in leading-edge research
- ▲ Demonstration by the company of their support of CREOL, The College of Optics & Photonics, its research programs, and its effective corporate cooperation and partnership activities

In addition, we use many mechanisms to give visibility to our Industrial Affiliates that can be valuable to them in marketing their products. Wherever possible, the level of the membership is indicated. Examples of current practices include:

- ▲ Listing in the CREOL Highlights quarterly newsletter
- ▲ Special recognition at the annual Industrial Affiliates Day
- ▲ Listing in other CREOL publications, where appropriate, including on the CREOL website (with a link to the company's website)
- ▲ Company name plaque prominently displayed in the entrance lobby of the CREOL building

There are also many intangible benefits that accrue from association with this dynamic research and education institution. Among these are facilitated access to and collaboration with other specialized facilities within the University of Central Florida and the central Florida area. In addition to resources at CREOL and the Florida Photonics Center of Excellence (FPCE), UCF facilities include the following major research centers:

- ▲ NanoScience & Technology Center (NSTC)
- ▲ Advanced Materials Characterization Facility (AMPAC)
- ▲ Materials Characterization Facility (MCF)
- ▲ Biomolecular Science Center
- ▲ Institute for Simulation and Training (IST)
- ▲ Center for Distributed Learning
- ▲ National Center for Forensic Science (NCFS)
- ▲ Florida Solar Energy Center (FSEC)
- ▲ Florida Space Institute (FSI)

The College's faculty and students play leading roles in both local and international professional associations and can provide effective introductions to the extensive network of industry and expertise to which CREOL connects. Through the IA program companies can also readily connect with other optics, photonics, and industrial organizations through local Florida organizations in which the College maintains an active participation, including the Florida Photonics Cluster (FPC), the Laser Institute of America (LIA), Florida High Technology Corridor Council (FHTCC), the UCF Technology Incubator — ranked #1 in the US in 2004 — and a large family of laser and optics companies in the Central Florida region.

INDUSTRIAL AFFILIATES MEMBERS, 2017

LIFE MEMBERS

Cobb Family Foundation
Northrop Grumman Corporation
Nufern

MEMORIAM MEMBERS

Dr. Arthur H. Guenther and Dr. William C. Schwartz

MEDALLION MEMBERS

ALIO Industries
Breault Research

Coherent, Inc.
Newport
Northrop Grumman Laser Systems

Paul G. Suchoski, Jr
Synopsys

SENIOR MEMBERS

AFL Global
Amplitude Laser, Inc
CST of America
FARO Technologies

Futurewei Technologies
IPG Photonics
LAS-CAD GmbH
Lockheed Martin

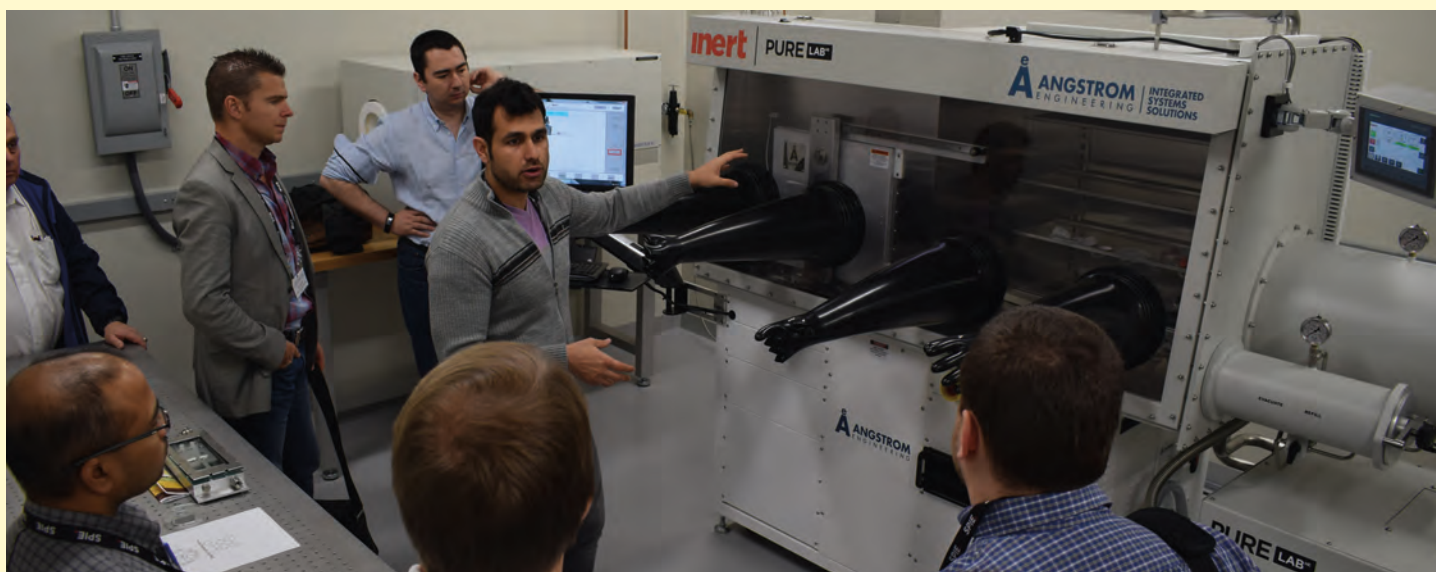
Optimax Systems, Inc
Tektronix
Zemax
Zygo Corporation

AFFILIATE MEMBERS

A & N Corporation
Aerotech Inc.
Analog Modules
Applicote Associates, LLC
Asphericon, Inc.
ASML US
Beam Co.
DataRay, Inc.
Edmund Optics
eVision, LLC
Fiberguide Industries
Gentec-EO, Inc
Gooch & Housego, LLC

Harris Corporation
HORIBA Jobin Yvon
IRadiance Glass, Inc
JENOPTIK Optical Systems Inc
Laser Institute of America
Menlo Systems Inc.
Ocean Optics
Ophir-Spiricon
Optigrate Corp.
OptoSigma
OIDA
Photon-X
Photonics Media

Photonics Online
Plasma-Therm
Plasmonics
Princeton Instruments
Q-Peak, Inc
SPIE - The International Society for Optics &
Photonics
The Optical Society
Thorlabs
Tower Optical Corporation
TwinStar Optics, Coatings & Crystals
ULVAC Technologies, Inc
Yokogawa



CREOL lab tour in a new biophotonics facility during the Industrial Affiliates Symposium in 2017.

INDUSTRIAL AFFILIATES DAY

Industrial Affiliates Symposium: *Advances in Optics & Photonics* March 16-17, 2017

The CREOL Industrial Affiliates event brings in optics companies from around the country to learn about the ongoing research, recruit students, and identify new partnering opportunities. The 2017 event, held on March 17 & 18, 2017, drew over 275 attendees including industrial affiliates, guests from industry and academia, representatives from photonics professional societies, faculty and students, and 23 exhibitors. Four technical sessions covered advances in various areas of optics and photonics. Four distinguished speakers from around the country and four UCF faculty speakers participated (see program details on the next page). In addition to the technical talks, three industrial affiliates gave brief overviews of their respective companies, a special guest Eugene Arthurs gave a presentation entitled "Reflections From SPIE".

Events also included four short courses, four student talks, tours of the CREOL facilities and viewing of posters featuring research of 27 graduate and undergraduate students. The Best Poster Award went to graduate student Alex Sincore for his poster entitled "Stimulated Brillouin scattering thresholds when amplifying a variable pulse duration, narrow-linewidth 2 μm fiber laser", The Student of the Year Award went to Hossein Hodaie. The following Saturday, the attendees were invited to the traditional annual event: The Spring Thing, hosted by Dr. M. J. Soileau, Founding Director of CREOL. The festivities included great fellowship and featured Cajun cuisine.

Short Courses

Photoconducting polymers and its applications Instructor

Instructor: Jayan Thomas, Associate Professor, NSTC

Topics covered in this tutorial include electronic delocalization, formation of highest occupied molecular orbitals (HOMO) and lowest unoccupied molecular orbitals (LUMO) and charge conduction in photoconducting polymers. A brief discussion about optical bandgap tuning in polymers will also be presented. In addition, application of photoconducting and hybrid materials in excitonic solar cells, organic light emitting diodes and photorefractive display devices will be discussed.

The fourth generation of optics

Instructor: Nelson V. Tabiryan, BEAM Co.

This short course provides an introduction into the principles of a new generation of optical components and systems enabling: thin gratings with near 100% diffraction efficiency; thin-film performing as a high-power lens, prism, spiral phase plate, or beam shaper, with spectral bandwidths comparable to that of glass; low-voltage optical switches; thin-film optical components providing versatile beam control functions such as all-electronic beam steering, switching between multiple focal points, spectral tuning, and variable transmission; ultralight and ultrathin films used for a very large telescope. The first generation of optics (G1) relied on shaping an optically transparent material such as glass. Modulating refractive index instead of shape – G2 – allows thinner components but compromises bandwidth. Anisotropic materials make available two more parameters for controlling light beams. LCD industry is exploring one of them, modulation of birefringence – G3. A recent breakthrough in optics, G4, relates to patterning optical axis orientation in the plane of anisotropic films, essentially, half-wave retardation films, and related geometrical phase modulation. Obtained as thin-film coatings on any desired substrate, including plastic, flat or curved, all varieties of optical functions can now be obtained using the same materials and processes. The 4G lenses, prisms, vortex waveplates, etc., are thin films of continuous structures combining the broadband efficiency of conventional optics with low-cost, roll-to-roll manufacturing, just by creating desired patterns of orientation of the anisotropy axis, by a touch of polarization modulated light.

Quantum cascade lasers

Instructor: Arkadiy Lyakh, Assistant Professor, NSTC

Fiber lasers, and more generally fiber optic elements, have become modular building blocks that are configured into systems ranging from high bitrate long-haul telecommunications networks to directed energy weapons systems. As fiber lasers continue to become more and more common in our every day lives, the definition of what is a fiber laser continues to evolve. This course will review the fundamental waveguide and material properties that are critical to the performance of fiber lasers. The ability to precisely and controllably engineer both the waveguide and material properties makes fiber lasers extremely attractive for generation/amplification of light that can be relatively easily integrated into systems providing temporal modulation, phase modulation, broadband wavelength tunability, dispersion management, polarization control, etc.

Optical trapping

Instructor: Ryan Gelfand, Assistant Professor, UCF CREOL

This technique, invented just over 30 years ago, has emerged as a powerful tool with broad-reaching applications in biology and physics. Capabilities for this tool have evolved from the simple manipulation of large micron sized objects to the measurement of nanoscale displacements of optically trapped objects. This short course will review progress in the development of optical trapping apparatus, including instrument design considerations, position detection schemes and calibration techniques, with an emphasis on recent advances. It will cover trapping methods for particles of a variety of sizes: including atoms, proteins, nanoparticles, microparticles and cells. Optical trapping is a pivotal method used in many labs and has led to advances in biophysics, medicine, and quantum computing; this class will provide the fundamentals for understanding this technique.

Presenters at the Industrial Affiliates Symposium			
Elizabeth Klonoff	Vice President for Research, UCF	Welcoming Remarks	
Bahaa Saleh	Dean & Director, CREOL, UCF	Welcome and overview	
Mathias Fink	Langevin Institute	Distinguished Seminar: Time reversal and holography with time transformations	
David H. Reitze	Executive Director, LIGO lab, Caltech	The final ballet of a pair of colliding black holes: LIGO and the dawn of gravitational Wave astronomy	
Xiaoming Yu	CREOL, UCF	Recent advances in ultrafast laser subtractive and additive manufacturing	
Robert F. Karlicek, Jr	Director, LESA, RPI	LEDs, IoT and the future of illumination: Creative destruction in the lighting industry	
Winston Schoenfeld	CREOL, UCF & FSEC,UCF	Predictive metrology: The next evolution of crystalline silicon PV manufacturing metrology	
Eugene Arthurs	Executive Director and CEO, SPIE	Reflections from SPIE	
Donald Keck	Corning	Through a glass brightly	
Ayman Abouraddy	CREOL, UCF	Advanced Functional Fabrics of America (AFFOA): From optical fibers to multi-functional textiles	
G�rard Mourou	Ecole Polytechnique, France	Extreme light: Beyond the horizon	
Martin Richardson	CREOL, UCF	High energy lasers – impact today, innovation tomorrow	
Product Reviews			
Blair Barbour	Photon-X		
Charles Middleton	Harris Corporation’s Photonics Core Technology Center		
Mel Kantor	Tower Optical		
Alex Fong	Gooch & Housego, LLC		
Student Talks			
Cheonha Jeon	Student of the Year: Fundamental studies of ultrashort laser pulse interaction with aerosols		
Amy Van Newkirk	Sensing with special optical fibers		
Jie Li	Mid-IR OPCPA laser for generating isolated attosecond pulse in the water window		
Awards Presentations			
Gabriel Popescu	University of Illinois	Distinguished Alumni Award	
James Pearson	CREOL, UCF	Special Distinguished Service Award	



Students listen to presentations at the Industrial Affiliates Symposium 2017 in the Pegasus Ballroom

STUDENT POSTERS AT THE INDUSTRIAL AFFILIATES SYMPOSIUM

Ashutosh Rao	High-performance electrooptic modulation and second-harmonic generation in thin film lithium niobate on silicon
Jian Zhao	Image Transport Through Silica-Air Random Core Fiber
Tracy Sjaardema	Integrated polarization control via topographically anisotropic photonics
Haley Kerrigan	Femtosecond-nanosecond dual-pulse laser ablation
Zhao Ma	Hemispherical focal plane arrays
Hussain M. Abouelkhair	The effect of sulfur vapor flow on the properties of MoS ₂ grown by LPCVD
Danielle Reyes	Diagnostics of Refractive Index Modifications Induced by Laser Filamentation
Z. Zanjabi	Annular Core Photonic Lantern OAM Mode Multiplexer.
Evan Hales	Wavelength tunable dual channel solid state laser for terahertz difference frequency generation
F.M. Kompama	Complex holographic elements in photo-thermo-refractive glass for the visible spectral region
Sarmad Fawzi Hamza Alhasan	Effect of deposition method on morphology of TiO ₂ thin films.
Salimeh Tofghi	Excited-state nonlinearities of Ir(III) complexes
Daniel Thul	Phase control of filamenting beams
Josh Bradford	Mode Characterization of Fiber Lasers Under Load
Richard Locke	Quantification of non-stoichiometry in transparent ceramics using laser-induced breakdown spectroscopy (LIBS).
Sepehr Benis	Time-Resolved Nonlinear Refraction and Absorption of Indium Tin Oxide at Epsilon Near Zero.
Milad I. Akhlaghi	Using fluctuations in coherent scattering for sensing through obscurants
Yang Yang Sun	High-speed compressive range imaging based on active illumination.
Guillermo F. Camacho Gonzalez	Octave-spanning supercontinuum generation in low-loss chalcogenide waveguides on silicon
S. Polkoo	Environmental Test of Quantum Dot Light Emitting Diode.
Zheyuan Zhu	X-ray coherent scattering tomography of textured material
Alex Sincore	Stimulated Brillouin scattering thresholds when amplifying a variable pulse duration, narrow-linewidth 2 μ m fiber laser
Qitian Ru	Instantaneous Spectral Span of 2.9 - 8.5 μ m Achieved in a Cr:ZnS Laser Pumped Subharmonic GaAs OPO
Qitian Ru	Octave-wide Gallium Phosphide OPO Centered at 3 μ m and Pumped by an Er-fiber Laser
Behnaz Davoudi	Using low-coherence interferometry to monitor cell invasion in an in vitro model system
M. Amin Eftekhari	Uniform ultra-broad supercontinuum generation in continuously tapered multimode graded-index optical fibers
Walker Larson	Super-Sensitive Ancilla-Based Adaptive Optical Phase Estimation



Exhibitors at the 2017 Industrial Affiliates Symposium

INDUSTRIAL PROJECTS

In Fiscal Year 2017, CREOL had industry sponsored research totaling over \$2.1M. Some of these projects are Federal Flow Thru while others are direct industry supported research and development. These collaborations gives our students experience and a leg up on industry positions after they graduate. Projects total: \$2,108,379

RECEPIENT	SOURCE	TITLE OF AWARD	BEGIN	END	AWARDED
PI: Abouraddy, A.	Lambda Photonics	Robust Mid-IR Optical Fibers for Extreme Environments	10/11/2016	1/14/2017	\$75,000
PI: Abouraddy, A.; CoPI: Li. Bai	Harris Corporation	Strong Ultra-Small Highly Integrated (SUSHI) Phase 2 Fiber Optic Cable (Prime 1)	4/3/2017	6/30/2018	\$349,076
PI: Amezcua Correa, R.	Harris Corporation	Application of Photonic Lantern Technology for RF Photonics and Telecom Applications	3/1/2017	11/29/2017	\$25,000
PI: Amezcua Correa, R.; CoPI: Schülzgen	SA Photonics	Negative Curvature Hollow Core Optical Fiber	6/28/2017	4/20/2018	\$39,984
PI: Amezcua Correa, R.; CoPI: Schülzgen	Saint Gobain	Scintillating Fiber	6/16/2017	11/30/2017	\$13,918
PI: Christodoulides, D.N.	Lockheed Martin Missiles and Fire Control	Advanced Optical Filters and Coatings	4/1/2016	2/28/2017	\$25,000
PI: Crabbs, R.F.	Aegis Technologies Group, Inc.	ARI: Testing at SLF	3/9/2017	8/31/2017	\$25,200
PI: Crabbs, R.F.; CoPI: Delfyett	Various	RF: Tracker System	7/1/2016	6/30/2020	\$5,000
PI: Divliansky, I.	OptiGrate Corporation	High efficiency uniform nonplanar holographic optical elements in photo-thermo-refractive glass	10/1/2016	3/30/2017	\$24,000
PI: Divliansky, I.	OptiGrate Corporation	Large-aperture single-transverse-mode ultra-short pulsed laser	7/15/2016	1/11/2017	\$24,000
PI: Dogariu, A.	Sherwin Williams Company	Modeling of Pigment Clusters in Paint Formulations	2/1/2017	1/31/2018	\$97,581
PI: Fathpour, S.	Partow Technologies, LLC	Thin film lithium niobate microring modulators for analog photonics	7/13/2016	7/9/2017	\$9,009
PI: Glebov, L.B.	OptiGrate Corporation	Laser diode array with diffraction limited divergence	12/1/2016	5/21/2017	\$30,000
PI: Li Guifang	Futurewei Technologies, Inc.	Fundamental research on few-mode fiber optical transmission	11/16/2016	11/15/2018	\$479,991

PI: Mingareev, H.	OptiGrate Corporation	Barium Silicate Glass Services	3/31/2017	5/15/2017	\$15,000
PI: Richardson, K.A.	Lockheed Martin Missiles and Fire Control	Advanced Materials IRAD - Broadband Gradient Index (GRIN) Optics	3/3/2017	12/22/2017	\$45,000
PI: Richardson, K.A.	Semplastics, LLC.	Large-Scale Molded Silicon Oxycarbide Composite Components for Ultra-Low-Cost Lightweight Mirrors	7/1/2016	4/24/2018	\$100,000
PI: Richardson, K.A.	Various	RF K. Richardson Equipment Use Account	1/1/2015	12/31/2018	\$40,444
PI: Richardson, K.A.	Lockheed Martin Missiles and Fire Control	Visible/SWIR Gradient Index (GRIN) Optics	2/1/2017	11/1/2017	\$25,000
PI: Richardson, K.A.; CoPI: Kuebler	Lockheed Martin Missiles and Fire Control	Broadband Gradient Index (GRIN) Optics Phase 3	12/14/2015	12/31/2016	\$14,540
PI: Saleh, B.	UCF Foundation, Inc	CREOL - UCF Foundation Gifts	7/1/2014	6/30/2018	\$122,645
PI: Schepler, K.; CoPI: Abouraddy, Shah	Lockheed Martin Corporation	ARI: Evaluation of the optical and mechanical properties of chalcogenide fiber	8/29/2016	6/30/2017	\$75,000
PI: Schoenfeld, W.V.	US Photovoltaic Manufacturing Consortium, Inc (PVMC)	PV Manufacturing Consortium	5/1/2016	4/30/2017	\$121,691
PI: Shah, L.	Lasera LLC	Trans-wafer laser packaging technology for sensitive MEMS devices	1/18/2017	6/8/2017	\$26,300
PI: Webster, S.	Raytheon Company	Comparison of Yb:YAG and Nd:YAG single crystals and ceramic samples	11/1/2016	8/31/2017	\$15,000
PI: Wu, S.T.	Intel Corporate Research Council	Fast-response liquid crystal devices for light field displays	11/15/2016	11/14/2017	\$75,000
PI: Wu, S.T.	Industrial Technology Research Institute (ITRI)	Optics for transparent OLEDs and high efficiency OLEDs	1/1/2017	12/31/2017	\$50,000
PI: Wu, S.T.	US Air Force Office of Scientific Research (AFOSR)	Submillisecond-response liquid crystal spatial light modulators	9/1/2014	8/31/2018	\$160,000

PHOTONICS INCUBATOR

The Photonics Incubator is part of the UCF Business Incubation Program and is located within the facilities of the College. It is one of the ways that the College fulfills one element of its mission, namely to "Aid the development of Florida's and the nation's high technology industries." Companies in the Photonics Incubator have ready access to the CREOL faculty, graduate students, laboratory facilities and other excellent UCF resources including the staff of the Office of Research and Commercialization and the Venture Lab. The following is a list of 2016 clients:

LC MATTER CORP.

LC Matter Corporation offers custom design and manufacturing of liquid crystal materials and its polymeric composites. Applications include military electronically driven laser devices, optical telecommunication and entertainment systems. Contact: Sebastian Gauza. www.lcmatter.com

sdPHOTONICS LLC

sdPhotonics is an emerging leader in the development of high power laser diode technologies that provide improved power, efficiency, brightness and reliability. Contact: Dennis Deppe

OLKIN OPTICS, LLC

Olkin Optics is developing specialty fiber optics and fiber components for telecommunications, sensing, medical and laser applications. Contact: info@olkinoptics.com

PLASMONICS, INC.

Plasmonics is developing tunable infrared metamaterials which are engineered composites with unique refractive-index characteristics. Metamaterials with tunable resonances have wide ranging potential for optical devices, modulators, and sensors. Contact: David Shelton. www.plasmonics-inc.com

VISITORS

Government Visitors

- ▲ Rick Schwerdtfeger, SBIR/STTR-NSF, November 30, 2017

Industry Visitors

- ▲ Juha Purmonen, Jyrki Saarinen, Photonics Finland, January 25, 2017
- ▲ Ankush Oberai, Synopsis Inc., Kumar Patel, Pranalytica, Inc., January 27, 2017
- ▲ Bert Gyselinckx, IMEC, February 1, 2017
- ▲ Manuel Andrade, Padtec SA, February 3, 2017
- ▲ Scott Fouse, Lockheed Martin, March 2, 2017
- ▲ David Braman, Greg Anderson, LaserStar Technologies Corporation, March 20, 2017
- ▲ Kimberly Friedman, Gregory Katz, Shimail Gillani, Charles Norburn, Carla Johnson, Microsoft, April 11, 2017
- ▲ Gustavo Montemurro, Sebastian Camus, VDS, April 28, 2017
- ▲ Chris Riehl, Kishore Lankalapalli, FARO, June 24, 2016
- ▲ Ron Driggers, St. Johns Optical Systems, May 10, 2017
- ▲ Chuck Mattera, II-VI Photop Corp., May 22, 2017
- ▲ Gustavo Montemurro, Sebastian Camus, VDS, June 26, 2017
- ▲ Wataru Kunishi, Koji Taniuchi, ROHM- Japan, August 25, 2017
- ▲ Aaron Weil, Dan Samuels, Central Florida Hillel, September 5, 2017
- ▲ Armand Niederberger, Leia Inc., September 15, 2017
- ▲ Calton Hill, Nat Quick, Calton Hill-Applicote, October 6, 2017
- ▲ Mike Scholten, Duke Littlejohn, Mark Durham, DRS Technologies; Tim Day, Daylight Solutions, December 11, 2017
- ▲ Thomas Smith, Capital Business Development Associates, December 12, 2017

University and Research Center Visitors

- ▲ Johnathan Brantley, UT-Austin, January 11, 2017
- ▲ Nitin Padture, Brown University, January 27, 2017
- ▲ Alex Vitkin, University of Toronto, February 3, 2017
- ▲ Andrea Alu, UT-Austin, February 21, 2017
- ▲ Jean-Claude Diels, UNM, March 16, 2017
- ▲ Rémi Carminati, Institut Langevin, ESPCI ParisTech, March 23, 2017
- ▲ Aditya Mohite, Los Alamos, March 31, 2017
- ▲ Amy Oldenburg, University of North Carolina at Chapel Hill, April 6, 2017
- ▲ Sharon M. Weiss, Vanderbilt, University, April 10, 2017
- ▲ Daniel L. Marks, Duke University, May 12, 2017
- ▲ Sanjeev J. Koppal, University of Florida, May 18, 2017
- ▲ Thomas Baptiste, National Center for Simulation, May 22, 2017
- ▲ Heikki Immonen, Karelia University of Applied Sciences, May 22, 2017
- ▲ Paul Corkum, University of Ottawa, June 13, 2017
- ▲ Xiao-Feng Qian, University of Rochester, October 30, 2017
- ▲ Lanlan Gao, Yongji Yu, Chunting Wu, Yuan Dong, Xinyu Chen, Ji Wang, Chao Wang, Changchun University of Science and Technology, November 27, 2017
- ▲ Rongwen 'Luke' Lu, Howard Hughes Medical Institute, December 1, 2017
- ▲ Chi Zhang, Boston University, December 8, 2017

Other Visitors

- ▲ Samindranath Mitra, Editor, Physical Review Letters, October 25

COLLEGE EVENTS



Several staff and faculty members traveled to the path of totality for the August 21 Total Eclipse.

CEO of Photonics Finland Visit

Juha Purmonen, CEO of Photonics Finland and his colleague Jyrki Saarinen came to CREOL to learn more about photonics in Florida and explore possible networking. He also provided some brief information on the Photonics Finland cluster:

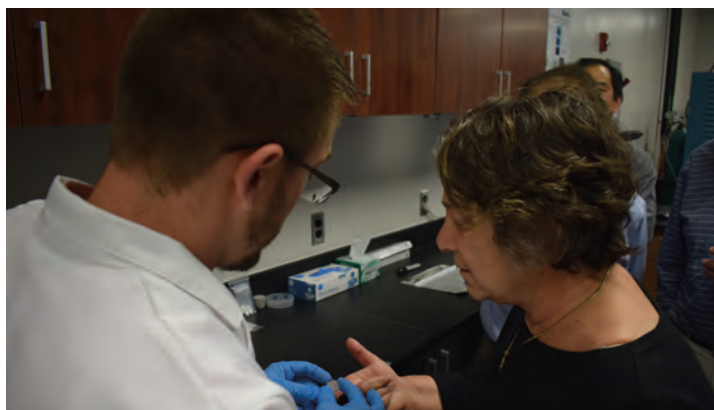
Photonics industry is growing in Finland. Currently there are about 200 photonics related companies in Finland. Photonics Finland has about 300 research members. January 25.

Morehouse and Spelman Students Visit

On February 24th, 19 students and two faculty members from Morehouse College, one of the premiere HBCU in the nation, came to UCF for a day-long visit. They toured several laboratories in Biomedical Sciences, Chemistry, Engineering, Optics, Physics, and Psychology, were taken on a campus tour by graduate students, and attended meetings with UCF faculty and students. Dr. Willie Rockward, who led the group during the visit, said that the purpose of this visit was to increase the students' interest in graduate school and to show them that one can find excellent graduate programs outside elite schools as well. He considers UCF a hidden gem, full of exciting opportunities. February 24.

National Academy of Inventors Visit

Five members of the National Academy of Engineering visited UCF during the week of February 27, 2017. They toured the CREOL laboratories and facilities on February 28 and met with Dean Saleh and several CREOL faculty. They discussed ideas for helping UCF attain its strategic goals. February 28.



Matthew Julian describes the fabrication process of optical ceramics on a thulium-doped YAG sample, a laser-gain medium for infrared applications to UCF Vice President of Research Liz Klonoff at the OML Open House.

OML Open House

Faculty and guests were given a guided tour of the transparent ceramic, IR glass and fiber preform labs. March 22.

Norwegian Students Visit

Twenty-four physics and math majors from the Norwegian University of Science and Technology visited UCF as part of their traditional trip abroad, which they take at their 3rd year. They were hosted by the Department of Physics, where they toured labs and met faculty and students. They also visited and toured laboratory in mathematics and CREOL. April 7.

Senior Design Day

The Senior Design Day showcased senior design student projects from Mechanical & Aerospace Engineering (MAE), Industrial Engineering & Management Systems (IEMS), Electrical & Computer Engineering (ECE), Computer Science (CS) and Photonic Science and Engineering (PSE). April 21.



PSE undergraduates Hamilton Shinto (L) and Ahmad Azim (R) present their senior design project "Infrared Spectroscopy Techniques for Pesticide Detection"

STEM Initiative Brings High Schoolers to BRIDG and UCF

Osceola County high school students toured the smart-sensor manufacturing facility BRIDG and UCF's NanoScience Technology Center as part of a new initiative designed to prepare students for high-tech fields.

The program is part of an ongoing effort by the Osceola County School District to expand its STEM curriculum. To create the

new initiative, the School District has partnered with the SEMI Foundation, a California-based nonprofit organization that supports education and career awareness in the electronics and high-tech fields.

The result of the partnership is Osceola's SEMI High Tech University, a three-day workshop for high school students who want to know more about technology careers. Students work directly with industry experts and participate in hands-on workshops. Osceola is the first school district in Florida to adopt the internationally acclaimed program. June 14.

Chris King, Democratic candidate for governor of Florida & Linda Chapin, Orange County's first Mayor Visit

Chris King, candidate for governor of Florida (D, Winter Park,) visited CREOL Aug. 18, 2017 together with Ms. Linda Chapin, Orange County's first Mayor and also founder of UCF's Metropolitan Center for Regional Studies. Dean Saleh gave the guests a brief overview of the academic and research programs and Professors Delfyett and Abouraddy and their students gave the visitors tours of their laboratories. CREOL welcomes the opportunity to host political and community leaders to help inform them about optics and photonics technology and the critical role that this technology plays in Florida and the nation's economy. Examples of partnerships with industry, spin out of new technology, and new companies based on the research findings of the faculty and students were discussed. July 18.



Peter Delfyett, Chris King (Florida gubernatorial candidate), Bahaa Saleh, Ayman Abouraddy, Felix Tan, Linda Chapin (First Orange County Mayor) & M.J. Soileau

Solar Eclipse

CREOL was one of many locations on the UCF campus where students, staff, and faculty witnessed the Great American Solar Eclipse of 2017. Although coverage was 85%, the sky cleared to allow participants to witness the partial solar eclipse. Other members of CREOL traveled to the path of totality in Oregon, Tennessee, and Washington. August 21.

ROHM and IMEC Visit

Koji Taniuchi, General Manager of Fundamental R&D Division; and Wataru Kunishi, Assistant Research Engineer at ROHM (Japan) visited CREOL. They were accompanied by Dr. Umar Piracha and Dr. Sabine O. Neil from IMEC Florida to meet with Dean Saleh and other faculty members to explore research areas of interest and collaboration. ROHM is an industry leader in ICs, discrete components and module products, utilizing the latest



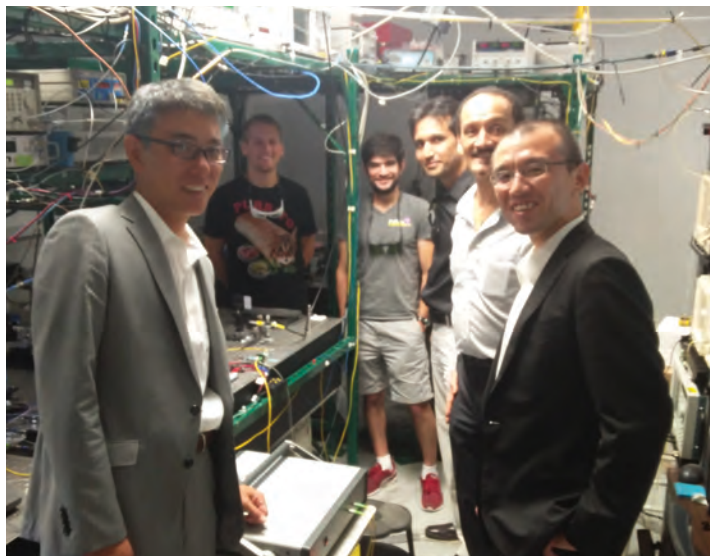
Students at CREOL observing the partial solar eclipse.

in semiconductor technology. They explored semiconductor based technologies, devices and systems for imaging and sensing applications. August 25.

IEEE Conference/CREOL Open House

The IEEE Photonics Society held its annual IEEE Photonics Conference (IPC2017) in Orlando this year. The conference covers a wide range of technologies spanning from Nonlinear Optics to Optical Communications to Sensors and Imaging. CREOL was well represented at the conference, presenting multiple talks and posters as well as a plenary session on "Nonlinear Material Responses and Their Characterization" by Dr. Eric Van Stryland and a special panel-session by Dr. Bahaa Saleh entitled "Photonics Research: Impacting Grand Challenges."

The college also held a special networking event at CREOL in conjunction with the conference. The student chapter of the IEEE Photonics Society organized this two-hour event, which included 23 student posters on display in the CREOL lobby accompanied student-led tours through six faculty labs. Over one hundred conference attendees made the trip across town from the IPC2017 venue in Lake Buena Vista to participate in this special event on the UCF campus. October 3.



Koji Taniuchi and Wataru Kunishi visit Peter Delfyett's Optical Frequency Synthesizer Lab.

Changchun University of Science and Technology Visit



Michael Bass (center) and visitors from Changchun University.

CREOL hosted a visit by 7 faculty members of the physics section of the Changchun University of Science and Technology (CUST). The point of contact was Prof. Lanlan Gao who had spent 2010 as a visiting scientist with Prof. Michael Bass. In 2014 Prof. Liang Li from the CUST engineering section spent 9 months with Prof. Michael Bass and arranged for Bass, Professor Axel Schülzgen, Dr. Scott Webster and Ms. Ying Chen (Research Scientists at CREOL) to visit CUST in 2015. At CREOL the Changchun faculty were introduced to CREOL faculty and students and visited the labs and facilities. November 31 – December 5.

ALUMNI NEWS

2017 Prism award goes to a team at NUFERN led by CREOL alum Clémence Jollivet

One of the SPIE 2017 Prism awards for Photonics Innovation went to a team at Nufern led by CREOL alum Clémence Jollivet at Photonics West on February 1, 2017. The award is for an optical fiber development called “NuBEAM flat-top fiber technology” that enables effective beam shaping and beam control.

Alum Matthew Weed featured in OPN article on photonics and politics (2/01/2017)

Alum Matthew Weed (chair of OSA Public Policy Committee and a member of the NPI steering committee) was featured in an Optics and Photonics News article “Uncertainty Principles: Photonics and Politics.” February. 1.

CREOL alum Clémence Jollivet promoted to Product Development Manager at Coherent

In July 2017 Clémence was promoted to Product Development Manager in the Fiber R&D Department of Coherent Inc. In her new role, she is leading a team of one scientist and two optical engineers and is responsible for pioneering optical designs of active and passive fibers at Coherent with superior performance in order to expand to new markets and enable new applications.

Gabriel Popescu Receives the 2017 Distinguished Alumni Award

Gabriel Popescu is an Associate Professor in Electrical and Computer Engineering, University of Illinois at Urbana-Champaign. He received his Ph.D. in Optics in 2002 from the School of Optics (now CREOL). He continued his training with Michael Feld at M.I.T., working as a postdoctoral associate. He joined UIUC in August 2007 and directs the Quantitative Light Imaging Laboratory (QLI Lab) at the Beckman Institute for Advanced

Science and Technology. Dr. Popescu served as Associate Editor of Optics Express and Biomedical Optics Express, Editorial Board Member for the Journal of Biomedical Optics and Scientific Reports. He authored a book, edited another book, authored 130 journal publications, 200 conference presentations, 32 patents, gave 165 lecture/plenary/invited talks. Dr. Popescu founded Phi Optics, Inc., a start-up company that commercializes quantitative phase imaging technology. He is OSA Fellow and SPIE Fellow.



Dr. Saleh (R) awarding Dr. Popescu the 2017 Distinguished Alumni Award at the Industrial Affiliates Symposium in March.

Featured Alumnus: Jason Eichenholz

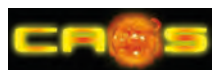
CREOL alumnus Jason Eichenholz, MS '95 and PhD '98, was a plenary speaker at the 2017 OSA FIO + LS meeting. Eichenholz is a Co-Founder & CIO of Luminar, a company revolutionizing automotive LIDAR systems. He is a serial entrepreneur and pioneer in laser, optics and photonics product development and commercialization. Over the past 25 years, he has led the development of hundreds of millions of dollars of new photonics products. Before joining Luminar, he was the Chief Executive and Founder of Open Photonics, an open innovation company



Luminar Co-Founders Jason Eichenholz (L) and Austin Russell demonstrate sensing technology employed in autonomous vehicles.

dedicated to the commercialization of optics and photonics technologies. Prior to that, he served as the Divisional Technology Director at Halma. Before joining Halma, he was the CTO and Board Member of Ocean Optics, as well as the Director of Strategic Marketing at Newport/Spectra-Physics. Eichenholz is a fellow of SPIE and OSA. He holds a courtesy faculty appointment at CREOL and is a recipient of the UCF 2013 Professional Achievement Award. He has served as the principal investigator for Air Force- and DARPA-funded research and development programs, and holds ten US patents on new types of solid-state lasers, displays and photonic devices.

STUDENT ORGANIZATIONS



CAOS, the CREOL Association of Optics Students, is a student organization founded in 1999 to bring together the diverse population of graduate students of CREOL, The College of Optics and Photonics. CAOS facilitates communication and integration of the student chapters of seven optics and photonics societies.

President: Stefan Gausmann
Vice President: Tao Zhan
Treasurer: Mahed Batarseh
Secretary: Rachel Sampson
Webmaster: Chenyi Zhang



The Society aids in promoting close cooperation with other IEEE societies and councils in the form of joint publications, sponsorships of meetings, and other forms of information exchange. Appropriate cooperative efforts will also be undertaken with non-IEEE societies.

President: Yuge "Esther" Huang
Vice President: Chenyi Zhang
Treasurer: Lawrence Trask
Secretary: Suyuan Chen
Webmaster: Zheyuan Zhu



The purpose of the chapter shall be to promote the discipline of Optics through a organized effort of study, research, and discussion. We shall disseminate the knowledge of the field of Optics to the general public and further the professional development of all our student members.

President: Sepehr Benis
Vice President: Rachel Sampson
Treasurer: Yuanhang Zhang
Secretary: Brittany Keys
Webmaster: Nicolette Fudala



The mission of SPIE Student Chapter is to advance an interdisciplinary approach to the science and application of light and provide professional development opportunities for UCF students.

President: Steffen Wittek
Vice President: Stefan Gausmann
Treasurer: Nicholas Cox
Secretary: Sanaz Faryadras
Webmaster: Taiki Kawamori



The mission of the Society of Optics Students is to uphold the principles of academic excellence, peer mentoring, leadership, and entrepreneurship to make an impact in the discipline of optics and photonics. The purpose of this Chapter shall be the advancement and diffusion of knowledge of the science of optics/photonics and the encouragement of student interest in optics/photonics throughout the academic and local communities. SOS is geared towards representing the new undergraduate population at CREOL.

President: Latifah Maasarani
Vice President: David Guacaneme
Secretary: Jordin Rosser
Treasurer: Austin Singh
Outreach: Charles Volz



SID, the society for information display is comprised of the top scientists, engineers, corporate researchers, and business people of the display industry. The SID UCF chapter is aimed to disseminate the knowledge of the field of displays to the general public and further the professional development of all our student members

President: Fangwang "Grace" Gou
Vice President: Tao "Tommy" Zhan
Treasurer: Kun "Kelly" Yin
Secretary: Ziqian He
Webmaster: Jianghao "Jasper" Xiong



The mission of WiLO is to promote personal and professional growth for women of CREOL in the field of Optics, Photonics and Lasers through community building, networking opportunities, and encouraging young women to choose optics as a career. This organization will also work towards preparing all CREOL students, enrolled in undergraduate and graduate degrees, for the transition from student to professional life.

President: Salimeh Tofighi
Vice President: Mahed Batarseh
Treasurer: Nafiseh Mohammadian
Secretary: Sanaz Faryadras
Webmaster: Jinhan Ren

EDUCATIONAL OUTREACH

Florida Science Olympiad

The College of Optics and Photonics sponsored the Florida Science Olympiad State Tournament where middle and high students compete in 23 science and engineering events and vie for honors to attend the national tournament. Several events are used to highlight optics based events. UCF hosts 84 schools around the state of Florida, with nearly 2000 spectators and participants in attendance. March 25.

SPIE / CREOL Outreach

Sponsored by SPIE, Mike McKee presented a workshop for 50 science teachers at the National Science Teachers Association annual conference in Los Angeles, CA. They learned about the basics of light, waves and optics. SPIE provided a kit of materials and the book of lesson plans developed by the College. April 2.

UCF STEM / Optics Day

CREOL opened its doors for the annual Optics Day, a fun-filled event of lab tours, optic demos, exciting talks, and prizes. The CREOL lobby was filled from back to front with demos, and our leading researchers presented exciting talks on their research for the attendees. In between the talks and checking out the demos, attendees had a chance to take a lab tour through CREOL visiting three different research groups. March 31.

Optics Workshop for Science Olympiad

At the annual Science Olympiad summer institute in Phoenix Arizona, Mike McKee conducted a workshop for 110 teachers on the "Optics" event. This event is one of 23 held at 7000 Science Olympiad tournaments held around the nation. Teachers learned about ray diagrams, optical properties, and the electromagnetic spectrum. July 18.

SPIE / COP Outreach Workshop

Mike McKee presented a workshop at SPIE San Diego on the basics of light. Graduate students and local elementary teachers attended

this 4 hour workshop and learned about the electromagnetic spectrum, lenses and mirrors, and how light travels. Participants were given a light kit from SPIE and a book of lesson plans from CREOL. August 8.

IEEE Photonics Conference Attendees Visit

During IEEE Photonics Conference, CREOL hosted an open house event and 103 conference attendees visited CREOL. This event included a welcome remark by Dean Bahaa Saleh, a student poster session/social hour, and 6 lab tours. The open house aimed to introduce CREOL research to professionals in photonics and to enhance potential partnerships. October 3.

DiSti Charity Golf Tournament

A charity golf tournament benefiting K-12 STEM education through the Central Florida STEM alliance. S.O.S. members provided a range of miscellaneous services during the event including setup, photography, manning the check-in booth, and clean up. October 16.

UCF STEM Day

S.O.S. got to give what has become an annual presentation on light and spectroscopy for a variety of schools that visited CREOL. Learning about the wave properties of light, how colors work, and how diffraction grating glasses work, kids got to discover the answer to the question: how do we know what the sun is made from? October 27.

SPIE Student Chapter Outreach

The SPIE chapter was invited to the Riverdale Elementary School to take part in a Teach-in. The officers Sanaz Faryadras and Steffen Wittek let a hundred kindergarden kids investigate the emission spectra of various lamps through the use of diffraction glasses. November 17.



Sanaz Faryadras introduces children from elementary school to the exciting world of optics through diffraction glasses

STUDENT PROFESSIONAL DEVELOPMENT

Optimizing Super-Resolution Microscopy for High-Throughput Imaging and Cell Biology: Kyle Douglass

In this presentation, Kyle talked about his research after graduating from CREOL with PhD degree and his experience in working directly with biologists to build an automated, high-throughput, super-resolution system capable of imaging hundreds of cells with nanometer-scale resolutions in a matter of hours. The goal of his work is building an understanding of how proteins are packaged together inside an organelle called the centriole and how DNA is folded inside the nucleus. January 9

Photonics West 2017

S.O.S. fundraised to send eight undergraduate students to SPIE's Photonics West conference in San Francisco. The students were able to collectively attend over 100 events at the conference. They learned about the latest research happening in the optics field, networked with professionals and peers in their respective fields, and volunteered at the CREOL exhibition booth. A few of the students obtained internships/jobs from the experience. S.O.S. would like to thank our sponsors OptiGrate, UCF Business Incubation Program, E.R. Precision Optical, and the Florida Photonics Cluster for making this opportunity possible for our students. January 28.

Thought process and steps of starting a scientific company: Carol Ann Dykes

Ms. Carol Ann Dykes manages the University of Central Florida Business Incubator in the Central Florida Research Park. In this presentation, she explained the process and steps of starting a company and introduced the UCF's business incubator program. Consequentially, two chapter members joined a follow-up tour at her incubator facilities, to learn about entrepreneurship. February 20.

Seminar by Dr. Matt Weed from Open Photonics R&D

S.O.S. invited CREOL Alumni Dr. Matthew Weed to share his educational, career, and leadership experiences in the optics industry and to inspire students to pursue higher-education degrees along with entrepreneurial opportunities. March 16.

Vision Engineering High Bay Site Tour

A group of ten S.O.S. members visited Vision Engineering's High Bay Site to learn about their optical systems, what it took to build their hardware. April 7.

My role at OSA – utilizing your needs to shape our goals: Terence Rooney

Terence represents the education outreach branch of OSA and is responsible for ensuring that students and early-career professionals are provided the resources needed for success in their careers. In his talk, he explained the professional opportunities in OSA and OSA foundation for students and early-career professionals. May 25.

Transitioning from science into industry: my journey from ultra-cold atoms to super-hot applications:

Armand Niederberger

Mr. Armand Niederberger is the director of data science and algorithms at LEIA Inc. In his talk, he traced his own path from quantum optics theory to optimization, and electrodynamics simulations, which led him to take a position at a startup in programming. His presentation was focused on the ways to transfer skills from academia to industry, the mindset that advances your career, and how to construct an interesting, fulfilling and fun professional life after graduation. September 15.

Resume Workshop with UCF's Career Services Department

Mari Rains from Career Services presented to S.O.S. members techniques for STEM resume writing. She offered a resume critique session to the students in attendance. September 21.

Lunch and Learn: Career Panel

S.O.S. invited Dr. Richard DeSalvo from Harris Corporation and Dr. Marc Himel of Jenoptik to present to their members on their educational and career backgrounds, and how to successfully transfer from university to industry. The session concluded with a Q&A session. September 22.

Luminar Site Tour

Students of the Frontiers of Optics and Photonics class along with members of S.O.S. visited Luminar's site tour to learn about their emerging technologies in autonomous vehicles. September 29

"Getting into Graduate School" Panel

S.O.S. invited Dr. Sudipta Seal of the Material Science and Engineering Department, Dr. Mercedeh Khajavikhan and Dr. Axel Schülzgen of CREOL to present to their members on the graduate school application process. The panelists discussed the average day of a graduate student, how to prepare to be accepted into the top graduate schools and provided insight on what a selection committee looks for in graduate student applications. October 17.

Northrop Grumman Panel of Engineers

A panel of engineers from Northrop Grumman was invited to speak at CREOL. The panelists included a variety of engineering disciplines including systems, electrical, and optical, two of whom were CREOL alumni. After a half hour of questions from the moderator, the floor was opened for questions from the audience. This was followed by an audience meet and greet with each other as well as with the panel members. November 13.

"Getting into Undergraduate Research" Panel

S.O.S. invited Aubrey Kuperman from UCF's Office of Undergraduate Research along with three UCF students to give a talk on the importance of participating in undergraduate research. The panelists discussed their research experiences and how to become involved in research both at UCF and at other research institutions. November 21.

OSA GRADUATE RESEARCH SYMPOSIUM

In this series of talks sponsored by the student chapter of OSA at CREOL, graduate students presented on research they have been conducting at CREOL. The purpose of the new symposium is to internally educate our researchers, promote collaboration, and give students practice at presenting.

Aug 16, 2017	“Real-time intraoperative monitoring of blood coagulability via coherence-gated light scattering” by Jose Rafael Guzman-Sepulveda “Nanophotonic lithium niobate frequency converters” by Ashutosh Rao
Nov 15, 2017	“Super-Sensitive Ancilla-Based Adaptive Quantum Phase Estimation” by Walker Larson “A Time-Gated Approach to Optical Diffraction Tomography” by Seth Smith-Dryden

PROFESSIONAL SOCIETY TALK SERIES

In a series of talks hosted by one of the professional student societies in the college, industry professionals and invited faculty give a non-technical talk geared around professional development, soft skills, or broader perspectives. These talks provide an intimate setting for the students to better know topics in the field, while simultaneously passing down knowledge from career experts.

DATE	SPEAKER	TITLE	SPONSOR
2/3/2017	Alex Vitkin	Visiting Lecturer: “Photon Mayhem: Using light for structural and functional assessment of biological tissues”	SPIE
2/10/2017	Charles Middleton, Harris Corporation	Visiting Lecturer: “Use of Photonics for the Transmission and Processing of Microwave Signals”	SPIE
03/13/2017	Kenichiro Masaoka, NHK	“Wide-gamut UHDTV System Colorimetry and Display Gamut Metrology”	SID
03/28/2017	Quan Li, Kent State University	“Light-Directing Self-Organized Chiral Liquid Crystalline Nanostructures: From 1D to 3D Photonic Crystals”	SID
4/3/2017	J. Stewart Aitchison, University of Toronto	“Photonics for Point of Care Diagnostics”	IEEE PS
4/10/2017	Sharon Weiss, Vanderbilt University	“Exploiting Light-Matter Interaction in Silicon Photonics for Biosensing”	IEEE PS and WiLO
07/05/2017	Chain-Shu Hsu, National Chiao-Tung University	“Design and Synthesis of Liquid Crystals for Organic Thin Film Transistors”	SID
07/17/2017	Michael Wittek, Merck	“Liquid Crystals for Non-Display Applications”	SID
08/17/2017	Ibrahim Abdulhalim, Ben Gurion University	“Improved Liquid Crystal Devices are Boosting Optical Imaging”	IEEE and SID
9/20/2017	Aydogan Ozcan, University of California, Los Angeles	“Democratization of Next-Generation Microscopy, Sensing and Diagnostics Tools through Computational Photonics”	IEEE PS
10/06/2017	Ronald Driggers	Faculty Talk: “Career Advice for Graduate Students, Post-Docs, and Young Faculty”	SPIE
11/17/2017	Nicholas Cox & Roy Choudhury	Workshop: Mathematica	SPIE
11/22/2017	Sandy Avila	Workshop: “Apps Grad Students Should Love”	SPIE
12/11/2017	Leo Keller, Keller Associates	“Automotive LCD Smart-Glass Applications in Europe”	SID

STUDENT ORGANIZATION SOCIALS AND MENTORING

DATE	ACTIVITY	SPONSOR
01/20/2017	Graduate and Undergraduate CREOL Students	SPIE
08/18/2017	Graduate and Undergraduate CREOL Students	SPIE
09/28/2017	Society of Optics Students and CAOS Bowling	CAOS
09/29/2017	Graduate and Undergraduate CREOL Students	SPIE
10/26/2017	Society of Optics Students and CAOS Bowling	CAOS
11/04/2017	Fall Picnic at Lake Claire	CAOS
11/30/2017	Society of Optics Students and CAOS Bowling	CAOS

SOCIETY OF OPTICS STUDENT ACTIVITIES

EVENT	AMOUNT HELD FROM FALL 2016-FALL 2017	EVENT TYPE
General Body Meetings	12	Informational
Resume Workshop	4	Professional Development
Northrop Grumman Panel	2	Professional Development
Grad/Undergrad Mentor Socials	7	Team Building
Graduate Students Seminars	7	Informational/Professional Development
Getting into Graduate School Panel	1	Informational/Professional Development
Undergraduate Research Panel	1	Informational/Professional Development
Transitioning to Industry from University Panel	1	Informational/Professional Development
SWE Mystery Design	2	Volunteering
DiSTi Duffer Charity Golf Tournament	2	Volunteering
STEM Science Fair Judges	1	Volunteering
Science Olympiad	1	Volunteering
STEM/Optics Day	3	Volunteering
Luminar Site Tour	1	Informational/Professional Development/ Networking
Dr. Matt Weed: Invited Guest Speaker	1	Informational/Professional Development
Irradiance/Burns Technologies Lab tour	1	Informational/Professional Development/ Networking
Vision Engineering Lab Tour	1	Informational/Professional Development/ Networking
Partial Proceeds Restaurant Events	8	Team Building
"Welcome to CREOL" Social	1	Team Building
End of the Semester Social	2	Team Building
Affiliates Day Student/Affiliate Networking Mixer	1	Networking/ Team Building
Photonics West Travel and Funding	2	Professional Development/ Networking
Study Room for members	20+	Team Building/Academic Excellence



UCF

CREOL, The College of Optics and Photonics

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