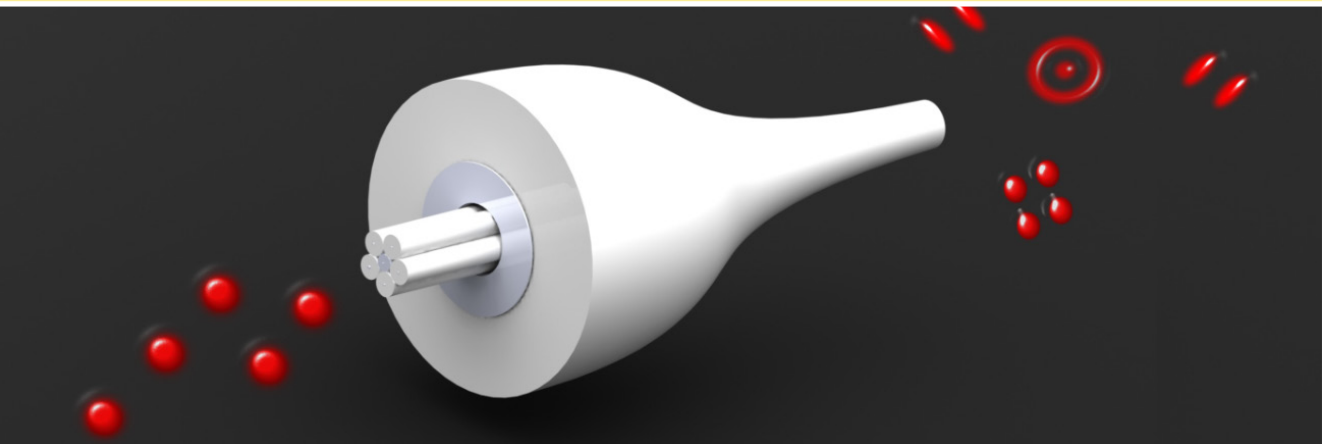
Annual Report

University of Central Florida

CREOL – The College of Optics and Photonics

2015



CREOL

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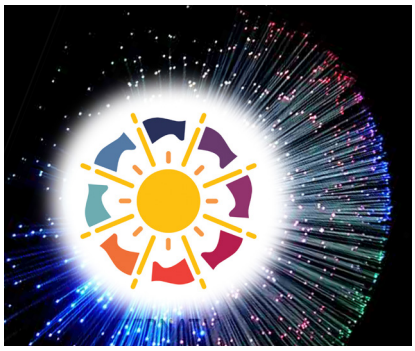
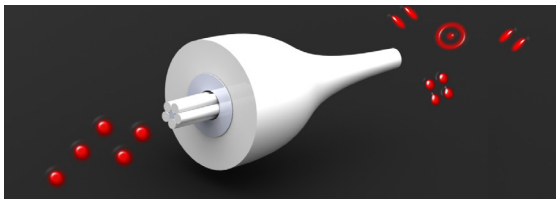
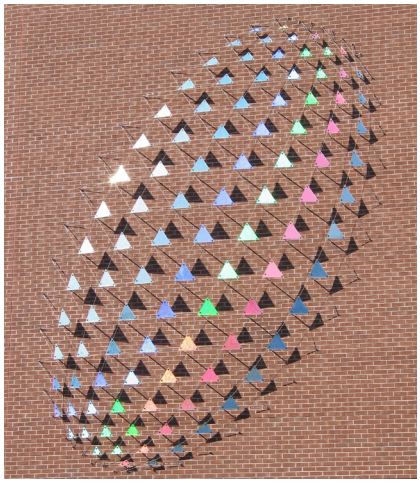


INTERNATIONAL YEAR OF LIGHT 2015

Cover: Adapted from the logo of the 2015 International Year of Light – a global initiative that highlighted to the citizens of the world the importance of light and optical technologies. *Graphic by Mike McKee.*



Cover: All-fiber photonic lantern mode multiplexer for space-division multiplexed optical communication. Single-mode fibers are one-to-one mapped to modes of a multimode fiber. .



Back cover: The *elliptic lens*: artwork by Ray King Studio placed on the facade of the CREOL building. The gonfalon of the College of Optics and Photonics, right, is inspired by this oeuvre.

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 in Electro-Optics and Lasers (CREOL) and became a 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).

During the last 29 years, CREOL has graduated 283 PhD and 387 MS students. World-renowned for their scholarly contributions to fundamental and applied optics and photonics, the faculty have published 30 books and more than 2,100 journal papers with close to 48,000 citations.

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, and imaging, sensing and display. These technologies have applications in manufacturing, communication and information, biology and medicine, energy and lighting, and homeland security and defense. Advanced topics such as nanophotonics, attosecond optics, plasmonics, and biophotonics are embraced as areas of strength and future growth. We are well positioned to take advantage of the revolution that is taking place in several fields enabled by optics and photonics.

CREOL was initially founded to promote growth in optics and related fields here 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 strong support from the *Florida High Tech Corridor Council* and *Enterprise Florida*. The CREOL Industrial Affiliates Program has attracted more than 170 industrial members since its founding. The faculty have produced close to 280 patents, and spun off 26 photonics-based companies involving a wide variety of technologies. Four companies are incubated within the CREOL facilities.

Highlights of 2015 include the addition of five new junior faculty members. Dr. Shuo (Sean) Pang, who received his PhD from California Institute of Technology and was a postdoctoral fellow at Duke University, started in January 2015 and is pursuing research in optical imaging and microscopy. Drs. Kyle Renshaw and Ryan Gelfand joined the college in Fall 2015. Renshaw, who received his PhD from the University of Michigan and had an appointment with Northrop Grumman, is active in organic photovoltaics and optical sensor arrays. Gelfand's research area is nanophotonic biosensing. He received his PhD from Northwestern University and was an NSF Postdoctoral Fellow at the University of Victoria. Joining the college in Spring 2016 are Drs. Kye Young Han and Luca Argenti. An expert in fluorescence nanoscopy, label-free single-molecule and live-cell RNA imaging, Han received his PhD from Seoul National University and the Max Planck Institute for Biophysical Chemistry, and was a postdoctoral fellow at the Howard Hughes Medical Institute. Argenti, who received his PhD from Scuola Normale Superiore di Pisa, Italy, and was a faculty member with the Universidad Autónoma de Madrid, is active in theoretical attosecond science. These five appointments are envisioned to fill important needs in applied optics and image science, and to strengthen our programs in integrated photonics, nanophotonics, biophotonics, and attosecond optics.

Another key highlight is the award of our first *BS degree in Photonic Science and Engineering.* This new undergraduate program, which began in Fall 2013, continues to grow. In 2015, 13 courses and 5 labs were offered. Current enrollment is approximately 100. In AY 2014. 2015,121 graduate students were enrolled, and 18 PhD degrees and 17 MS degrees were awarded. Graduate students continue to receive national scholarships, fellowships, travel grants, and best papers or poster awards.

The CREOL faculty continue to receive prestigious national and international awards and honors. Aristide Dogariu received the 2015 SPIE Stokes Award in recognition of his work on the polarization properties of light-matter interaction. Guifang Li was elected Fellow of the National Academy of Inventors, and Martin Richardson was elected Fellow of AAAS. Peter Delfyett was elected Fellow of SPIE and Fellow of the National Society of Black Physicists. He was also elected Vice-Chair of the APS Division of Laser Science. Mercedeh Khajavikhan received an NSF CAREER award. At the university level, Sasan Fathpour received the UCF Reach for the Stars Award and Ayman Abouraddy received the UCF Research Incentive Award.

The research conducted by the CREOL faculty, students, and scientists was disseminated nationally and internationally in 5 book chapters, 171 journal papers, 169 conference papers and presentations, and 22 invited lectures. This year, 14 papers were published in Nature journals, and one in Optica. Research and educational programs were funded by contracts and grants totaling approximately $14.7M in FY 2015. Our tradition of innovation has also continued. In 2015, the faculty were inventors or co-inventors of 15 issued patents.

Our 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 experience and a leg up on industry positions after they graduate. Several companies donated equipment for our laboratories. The 2015 Industrial Affiliates Day events were attended by 240 guests and 25 exhibitors, the students presented 39 posters, and four short courses were offered. CREOL maintains an ongoing relation with its alumni and holds regular alumni reunions at key conferences. Achievements of our successful alumni are highlighted in newsletters and on the CREOL website. This year's recipient of the Professional Achievement award is Frank Effenberger, Ph.D.'95, Vice President and Fellow at Futurewei Technologies, and a world expert in the field of fiber access networks.

The CREOL Association of Optics Students (CAOS) has maintained its strong involvement in outreach and professional development. This year, a new undergraduate student organization, the Society of Optics Students (SOS) joined CAOS. Another highlight of 2015 is the Florida Science Olympiad, which was held at UCF in March and in which CREOL was an important participant.

The year 2015 was very special for the worldwide optics and photonics community since it was the International Year of Light. A number of special public events were organized, including public lectures at the 2015 Industrial Affiliates Symposium, STEM teachers workshop, Optics Day, and a photo contest.

This annual report provides an overview of the education, research, and partnership activities of the faculty, staff, and students in 2015. Key data are also compared to previous years to show progress and identify trends. Academic data are reported for the academic year AY2015 (Fall 2014, Spring 2015, Summer 2015). Fiscal data, grants, and patents are reported for the fiscal year FY2015 (July 2014–June 2015). Publications are reported for the 2015 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

1. Faculty and Staff

1.1 Faculty

Ayman F. Abouraddy

Associate Professor of Optics and Photonics

PhD, Electrical Engineering, Boston University, 2003

raddy@creol.ucf.edu
(407) 823-6809

Research

Fabrication of multi-material micro-structured optical fibers, photonic band gap fibers, optical thermal, electric, and magnetic sensing using fibers, nonlinear 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 naopartide 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

- Research Initiative Award University-wide 2015
- Reach for the Stars Award 2014
- Teaching Incentive Program Award 2014

Rodrigo Amezcua Correa

Research Assistant Professor of Optics and Photonics

PhD Optoelectronics, University of Southampton, 2009

r.amezcua@creol.ucf.edu
(407) 823-6853

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 Developm**ent 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

Matthieu Baudelet

Research Assistant Professor of Optics and Photonics

National Center for Forensic Science

PhD, Physics, Université Claude Bernard Lyon 1, France, 2008

baudelet@creol.ucf.edu
(407) 823-6910

Research

Laser spectroscopy and sensing, analytical spectroscopy, atomic and molecular spectroscopy, chemometrics and quantitative spectral analysis, stand-off-detection, laser filamentation, molecular alignment, laser-induced plasmas, laser-matter interaction

Other Experience

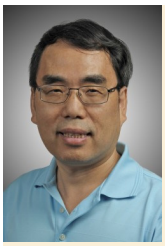
- Section co-chair for SciX, conference of the Federation of Analytical Chemistry and Spectroscopy Societies (FACSS)
- Manager of the LinkedIn group “Laser-induced breakdown spectroscopy”

Professional Activities

- President-elect of the North-American Society of Laser-Induced Breakdown Spectroscopy
- Member, editorial advisory board of Spectroscopy magazine
- Chair-elect, Society for Applied Spectroscopy Lester Strock Award

Honors and Awards

- 2013 UCF Research Millionaire



Zenghu Chang

Distinguished Professor of Physics & Optics and Photonics

PhD, Optics, Xi’an Institute of Optics & Precision Mechanics, 1988

Zenghu.chang@ucf.edu
(407) 823-4442

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

PhD, Electrical Engineering, Johns Hopkins University, 1986

demetri@creol.ucf.edu
(407) 882-0074

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 Program Chair, CLEO/QELS, 2012
- Committee Chair, CLEO/QELS—QELS5, 2011
- Committee Chair, CLEO/IQEC-IQEC5, 2010
- Committee Chair, CLEO/IQEC-IQE5, 2009

Honors and Awards
- NSF Presidential Early Career Award for Scientists & Engineers
- Fellow, OSA, IEEE, APS
- APS Edward Bouchet Award
- UCF Pegasus Professor

Peter J. Delfyett

Trustee Chair and Pegasus Professor of Optics and Photonics, EE, & Physics

PhD, Electrical Engineering, City University of New York, 1988

delfyett@creol.ucf.edu
(407) 823-6812

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

Honors and Awards
- NSF Presidential Early Career Award for Scientists & Engineers
- Fellow, OSA, IEEE, APS
- APS Edward Bouchet Award
- UCF Pegasus Professor Award

Dennis Deppe

FPCE Endowed-Chair, Professor of Optics and Photonics

PhD, Electrical Engineering, University of Illinois, 1988

ddeppe@creol.ucf.edu
(407) 823-6870

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

PhD, Engineering, Hokkaido University, Japan 1994

adogariu@creol.ucf.edu
(407) 823-6839

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

Sasan Fathpour

Associate Professor of Optics and Photonics & ECE

PhD, Electrical Engineering, University of Michigan, 2005

fathpour@creol.ucf.edu
(407) 823-6961

Research
Silicon photonics, heterogeneous integrated photonics, optical interconnects, nonlinear integrated optics, nonlinear photovoltaic effect in semiconductors, Electronic-photonic integrated circuits.

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
- Senior Member, SPIE, IEEE and OSA
- Chair of Short Courses at Conference on Laser and Electro-Optics (CLEO)

Honors and Awards
- 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

PhD, Materials Science; Paris VI University, France, 2002

gaume@creol.ucf.edu
(407) 823-5683

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
- Consultants: Shasta Crystals, Cyanto Corporation, Silicon Light Machines

Professional Activities
- Member, SPIE, ACerS

Honors and Awards
- Dissertation Thesis Award, 2002.

Ryan M. Gelfand

Assistant Professor of Optics and Photonics

PhD, Electrical Engineering,
Northwestern University, Evanston , IL , 2013

ryan5@creol.ucf.edu
(407) 823-1385
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

PhD, Physics, State Optical Institute, Leningrad, 1976

lbglebov@creol.ucf.edu
(407) 823-6983

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

PhD, Physics, Heriot Watt University, 1985

hagan@creol.ucf.edu
(407) 823-6817

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

- Editor-in-Chief, Optical Materials Express (current)
- Topical Editor, J. Opt Soc. Am B., (2006-10)
- Principal Editor, Journal of Materials Research (2001-06)
- Program Chair, Frontiers in Optics (2013)
- Senior Member, IEEE

Honors and Awards

- Fellow, OSA
- Ranked by ISI as "Highly Cited Researcher"
- College of Optics & Photonics Excellence in Research Award (2010–11)

Aravinda Kar

Professor of Optics and Photonics, MMAE, EECS, & Physics

PhD, Nuclear Engineering, University of Illinois at Urbana-Champaign, 1985

akar@ creol.ucf.edu
(407) 823-6921

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

PhD, Electrical Engineering, University of Minnesota, 2009

mercedeh@creol.ucf.edu
(407) 823-6829

Research

Nanophotonics and silicon photonics, plasmonics and applied electromagnetics, laser physics, quantum optics, Non-Hermitian Photonics.

Other Experience

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

Professional Activities

- Member, OSA, SPIE
- Reviewer, Optics letters, Optics Express, Applied Physics letter, IEEE Photonics Technology Letter, Applied Optics, Optical Communication, Journal of Optical Society A and B

Honors and Awards

- Norton Fellowship, University of Minnesota, 2005

Pieter G. Kik

Associate Professor of Optics and Photonics & Physics

PhD, Physics, FOM Institute of Atomic Molecular Physics, Amsterdam (AMOLF), 2000

kik@creol.ucf.edu
(407) 823-4622

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

Stephen.kuebler@ucf.edu
(407) 823-3720

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, SPIE, ACS
- 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

PhD, Electrical Engineering, University of Wisconsin-Madison, 1991

li@creol.ucf.edu
(407) 823-6811

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
- IEEEE EDS Distinguishes Lecturer
- Fellow, OSA, SPIE
- Florida Photonics Center of Excellence (FPCE) Professorship

Patrick L. LiKamWa

Associate Professor of Optics and Photonics & ECE

PhD, Electronic & Electrical Engineering, University of Sheffield, UK, 1987

patrick@creol.ucf.edu
(407) 823-6816

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

PhD, EE, University of British Columbia, Canada, 1978

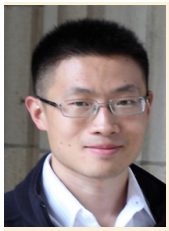
moharam@creol.ucf.edu
(407) 823-6833

Research
Diffractive holographic optics, Integrated photonics grating based devices, domputational 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

PhD, Electrical Engineering, Caltech 2013

pang@creol.ucf.edu
(407) 823-6869
http://oisl.creol.ucf.edu

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

C. Kyle Renshaw

Assistant Professor of Optics and Photonics

PhD, Applied Physics, University of Michigan, 2014

krenshaw@creol.ucf.edu
(407)823-2807
http://tfo.creol.ucf.edu

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

Professional Activities
- Member, Materials Research Society

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

Kathleen A. Richardson

Professor of Optics and Photonics, Materials Science, & Engineering

PhD, Ceramics, Alfred University, 1992

kcr@creol.ucf.edu
(407) 823-6815

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
- President, American Ceramic Society
- Member of the Board of Directors Society of Photo-Optical Instrumentation Engineers (SPIE)
- Associate Editor, International Journal of Applied Glass Science
- Coordinating Technical Council, International Commission on Glass
- Member of the Board of Trustees, Alfred University

Honors and Awards
- Fellow, OSA, SPIE, ACerS
- Outstanding Education Award, American Ceramic Society
- Tau Beta Pi Honor Society
- Samuel R Scholes Lecture and Award, Alfred University
- Fellow; Society of Glass Technology, United Kingdom

Martin C. Richardson

FPCE Trustee Chair; Northrop Grumman Prof. of X-ray Photonics; Pegasus Prof. of Optics and Photonics, Physics & ECE; Director, Townes Laser Institute

PhD, Physics, London University, 1967

mcr@creol.ucf.edu
(407) 823-6819

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

PhD, Electrical Engineering, Johns Hopkins University, 1971

besaleh@creol.ucf.edu
(407) 882-3326

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 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

Associate Professor of Optics and Photonics

PhD, Materials Science, Univ. of California, Santa Barbara, 2000

winston@creol.ucf.edu
(407) 823-6898

Research

MBE growth of oxide semiconductors (wurtzite and cubic), binary cubic oxide semiconductor solar-blind detectors, hybrid homoepitaxial zinc oxide-nitride laser diodes, cSi photovoltaics, passive/active photonic crystal nanocavity systems

Other Experience

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

Professional Activities

- Principal Editor, Journal of Materials Research
- Chair, MOEMS/MEMS Conference - Photonic West
- Executive Committee, Florida Chapter of the AVS
- Energy sub-committee Member, National Photonics Initiative

Honors and Awards

- Fellow, SPIE
- UCF TIP Award, 2010
- College Excellence in Graduate Teaching, 2009
- UCF Presidential Initiative Award, 2006

Axel Schülzgen

Professor of Optics and Photonics

PhD, Physics, Humboldt University, 1992

axel@creol.ucf.edu
(407) 823-1746

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

Honors and Awards

- 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

PhD, Physics, University of Central Florida, 2001

lshah@creol.ucf.edu
(407) 823-2066

Research

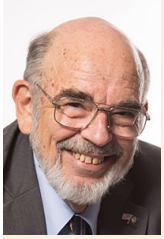
Fiber Laser, ultrafast lasers, thin disk lasers, nonlinear optics for wavelength generation in the near-and mid-IR, laser materials processing.

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
- Assistant Editor for IEEE Journal of Quantum Electronics

Professional Activities

- Member, SPIE, OSA



M.J. Soileau

Vice Pres., Research & Commercialization, Professor of Optics and Photonics, ECE & Physics

PhD, Quantum Electronics, University of Southern California, 1979

mj@ucf.edu
(407) 823-5538

Research

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

Other Experience

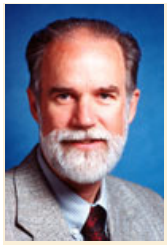
- Physicist, Naval Weapons Center Physics Div., China Lake, 1973-80
- Professor of Physics, North Texas State University, 1980-87
- Director, School of Optics/CREOL, 1987-99
- Chair of the Board, Orlando Science Center, 2002
- Technology-Based Economic Development; Technology Transfer
- Board of Directors,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

Professional Activities

- President, SPIE, 1997
- International Advisory Committee on Coherent and Nonlinear Optics, 2001
- Co-Chair, OSA/SPIE Joint Task Force, 1998-99

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, 2014v



Eric W. Van Stryland

Pegasus Professor of Optics and Photonics, Past Dean

PhD, Physics; Optical Sciences, University of Arizona 1976

ewvs@creol.ucf.edu
(407) 823-6835
http://nlo.creol.ucf.edu/

Research

Develop NLO spectroscopic techniques, e.g. Z-scan, measure nonlinear absorption spectra, e.g. two-photon absorption, 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-LEOS, 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

21 Century Scholar Chair, Professor of Optics and Photonics

PhD, Physics, Lebedev Physical Institute, Moscow, 1983

vodopyanov@creol.ucf.edu
(407) 823-6818
http://mir.creol.ucf.edu

Research

Mid-IR and THz generation via frequency downconversion, laser spectroscopy, nano-IR spectroscopy, supercontinuum generation in fibers, biomedical applications of lasers, standoff sensing and detection

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 (ISPDI), Beijing, China, 2013
- Photonics West, LA106 Conference Chair (2010-present)
- CLEO General Chair, 2010, CLEO Program Chair, 2008
- Associate Editor, Optica
- Co-author, Solid-Steate 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

PhD, Physics, University of Southern California, 1981

swu@creol.ucf.edu
(407) 823-4763

Research

Blue-phase liquid crystal displays, adaptive lenses, adaptive optics, biosensors, laser beam control, new photonic materials.

Other Experience

- Senior Scientist, Hughes Research Labs

Professional Activities

- SID Honors and Awards Committee
- SPIE G.G. Stokes Award 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
- 2011 SID Slottow-Owaki Prize
- 2010 OSA Joseph Fraunhofer Award
- Fellow, OSA, SPIE, IEEE

Boris Y. Zeldovich

Professor of Optics and Photonics & Physics

PhD, 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

PhD, Engineering, Michigan State University, 1970

Larry.andrews@ucf.edu
(407) 823-2418

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

PhD, Physics, University of Michigan, 1964

bass@creol.ucf.edu
(407) 823-6977

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

Glenn D. Boreman

Emeritus Professor of Optics and Photonics

Professor and Chair
Univ. North Carolina
PhD, 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 Electo-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

PhD, 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

PhD, Physics, University of Utah, 1965

silfvast@creol.ucf.edu
(407) 823-6855

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

In Memoriam: George I. Stegeman, 1942-2015

George Stegeman, Emeritus Professor of Optics and Photonics, passed away suddenly on May 2, 2015, at the age of 72. He joined the UCF faculty in 1990 and was the first recipient of the Cobb Family Chair in Optical Sciences and Engineering at UCF. The principal interest of Dr. Stegeman's research was the experimental study of nonlinear optics in waveguide structures, especially the properties of spatial solitons in various regions of the electromagnetic spectrum.

Dr. Stegeman was a fellow of the Optical Society of America (OSA) and the American Physical Society (APS). He received OSA's R.W. Wood Prize, the Hertzberg Medal for achievement in Physics of the Canadian Associate of Physics, and UCF's Researcher of the Year award. He received his PhD from the University of Toronto, along with honorary doctorates from NRS University in Canada and INAOE in Mexico.

Joint Faculty

Kevin D. Belfield

Department Chair & Prof. of Chemistry & Optics and Photonics

PhD, Syracuse University

Multiphoton Absorbing Materials

Belfield@ucf.edu

Louis Chow

Professor and Univ. Chair in Mechanical Engineering

PhD, University of California, Berkeley

Heat Transfer Issues in Electro-Optics

Louis.chow@ucf.edu

Andre Gesquiere

Assoc. Prof., Nanonscience Technology Center, Chemistry, & Optics and Photonics

PhD, University of Leuven

Optoelectronic Materials, Nanobiology

andre@ucf.edu

David Kaup

Provost Distinguished Research Prof. of Math & Optics and Photonics

PhD, University of Maryland

david.kaup@ucf.edu

Dr. Arkadiy Lyakh

Assistant Professor, NanoScience Technology Center

PhD, University of Florida

Arkadiy.Lyakh@ucf.edu

Seetha Raghavan

Assoc. Professor of MAE
PhD, Purdue University

Optical Characterization of Advanced Materials

Seetha.Raghavan@ucf.edu

Mubarak A. Shah

Agere Chair Professor of Computer Science & Optics and Photonics

PhD, Wayne State University

Computer Vision

Mubarak.shah@ucf.edu

Jayan Thomas

Assistant Professor of Nanoscience & Technology

PhD, Cochin University of Science & Technology

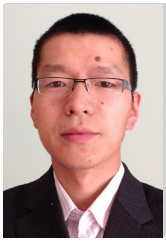
Jayan.Thomas@ucf.edu

Debashis Chanda

Assistant Professor, AMPAC/NSTC

PhD, University of Toronto

Debashis.Chanda@creol.ucf.edu



Yajie Dong

Assistant Professor, NSTC
PhD, Harvard University

Nanoelectronics and nanophotonics

Yajie.Dong@ucf.edu

Florencio E. Hernandez

Assoc. Prof. of Chemistry & Optics and Photonics

D.Sc., Universidad Central de Venezuela & Université Fracnhe-comté

Optical Materials

Florencio.hernandez@ucf.edu

Michael Leuenberger

Assoc. Prof. of Physics & Optics and Photonics

PhD, University of Basel

Quantum Information

Michael.leuenberger@ucf.edu

Robert E. Peale

Professor of Physics & Optics and Photonics

PhD, Cornell University

Defects in Semiconductors

Robert.peale@ucf.edu

Alfons Schulte

Professor of Physics & Optics and Photonics

Dr. rer. Nat, Technical University of Munich

Near-IR Raman Spectroscopy

Alfons.schulte@ucf.edu

Michael Sigman

Associate Professor of Chemistry & Optics and Photonics

PhD, Florida State University

Explosives, Chemistry & Forensics

Michael.sigman@ucf.edu

Thomas X. Wu

Associate Professor of EECS & Optics and Photonics

PhD, University of Pennsylvania

Numerical Techniques in Electromagnetics

Thomas.wu@ucf.edu

Cynthia Young

Professor of Math & Optics and Photonics

PhD, University of Washington

Laser Propagation in Random Media

Cynthia.young@ucf.edu

Courtesy Faculty

Kurt Busch

Prof. of Physics, Univ. Karlsruhe

PhD, University of Karlsruhe

kurt@tfp.uni-karlsruhe.de

Bruce H. Chai

President, Crystal Photonics

PhD, Yale University

chai@crystalphotonics.com

Jason Eichenholz

Divisional Technology Director, Halma CEO, Open Photonics, Inc.

PhD, CREOL, University of Central Florida

jason@open-photonics.com

James E. Harvey

Associate Professor of Optics and Photonics & ECE

PhD, Optical Sciences, University of Arizona, 1976

harvey@creol.ucf.edu

Hans P. Jenssen

AC Materials

PhD, MIT

h.jenssen@ac-materials.com

Eric G. Johnson

Professor of Physics & Optical Science

University of North Carolina Charlotte

PhD, University of Alabama

egjohnso@uncc.edu

Vassilios Kovanis

AFRL, Sensors Directorate

PhD, University of New Mexico

Semiconductor lasers, nonlinear optics

vassilios.kovanis@ucf.edu

Jannick Rolland

Brian J. Thompson Prof. of Optical Engineering, Prof. of Biomedical Engineering, University of Rochester

PhD, University of Arizona

Optical Diagnostics & Applications

rolland@optics.rochester.edu

Kenneth Schepler

AFRL, Sensors Directorate

PhD, University of Michigan

schepler@creol.ucf.edu

Emil Wolf

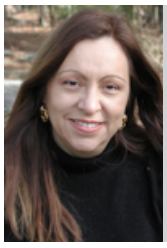
Wilson Professor of Optical Physics

PhD, Bristol University, England

Optical Coherence

ewlupus@pas.rochester.edu

Visiting Faculty



Angela Guzman

Visiting Research Associate Professor

Dr.Sc., Ludwig Maximilian University

Quantum Optics

angela.guzman@creol.ucf.edu

Malvin C. Teich

Visiting Research Professor

PhD, Cornell University

Quantum Optics

teich@creol.ucf.edu

Faculty Awards and Honors

OSA The Optical Society	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
	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
SPIE	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
IEEE photonics SOCIETY	2003 Engineering Achievement	Dennis Deppe
SID SOCIETY FOR INFORMATION DISPLAY	2008 Jan Rajchman Prize	Shin-Tson Wu
	2011 Slottow–Owaki Prize	Shin-Tson Wu
APS	2011 Edward A. Bouchet Award	Peter Delfyett
NSF	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)	Mercedeh Khajavikhan
ONR Science & Technology	ONR Young Investigator Award (1991)	Dennis Deppe
	ONR Young Investigator Award (1995)	Guifang Li
	ONR Young Investigator Award (2013)	Sasan Fathpour
ORAU OAK RIDGE ASSOCIATED UNIVERSITIES	Ralph E. Powe Junior Faculty Award (2009)	Ayman Abouraddy
John Simon Guggenheim Memorial Foundation	Guggenheim Fellow (1984)	Bahaa Saleh
The American Ceramic Society	ACerS Outstanding Educator Award (2009)	Kathleen Richardson

International Awards and Honors

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

Fellows of Professional Societies and Academies

OSA The Optical Society

Michael Bass	David Hagan	William Silfvast
Zenghu Chang	Guifang Li	M.J. Soileau
Demetrios Christodoulides	Jim Moharam	George Stegeman
Peter Delfyett	James Pearson	Eric Van Stryland
Dennis Deppe	Kathleen Richardson	Shin-Tson Wu
Aristide Dogariu	Martin Richardson	Boris Zeldovich
Leonid Glebov	Bahaa Saleh	

SPIE

Glenn Boreman	James Pearson	M.J. Soileau
Peter Delfyett	Kathleen Richardson	Eric Van Stryland
Leonid Glebov	Martin Richardson	Shin-Tson Wu
James Harvey	Bahaa Saleh	
Guifang Li	Winston V. Schoenfeld	

IEEE photonics SOCIETY

Michael Bass	Guifang Li	William Silfvast
Peter Delfyett	James Pearson	M.J. Soileau
Dennis Deppe	Martin Richardson	Eric Van Stryland
Sasan Fathpour	Bahaa Saleh	Shin-Tson Wu

APS

Zenghu Chang	Peter Delfyett	
Aristide Dogariu	Martin Richardson	
Demetrios Christodoulides	Eric Van Stryland	

Laser Institute of America
Laser Applications and Safety

Aravinda Kar	
Michael Bass	

SID
SOCIETY FOR INFORMATION DISPLA

Shin-Tson Wu	The American Ceramic Society www.ceramics.org	Leonid Glebov Kathleen Richardson

Michael Bass	AAAS	Martin Richardson

NAI
National Academy of Inventors

Michael Bass	Guifang Li	
Peter Delfyett	M.J. Soileau	
Leonid Glebov	Shin-Tson Wu	

Presidents, Directors and Officers of Professional Societies

OSA The Optical Society	Eric Van Stryland	President (2006)
	Michael Bass	Board of Directors Member (1989–1992)
	Peter Delfyett	Board of Directors Member (2004–2006)
	Bahaa Saleh	Board of Directors Member (1998–2005)
	Eric Van Stryland	Board of Directors Member (1998–2001)
	Shin-Tson Wu	Board of Directors Member (2013–2014)
SPIE	M.J. Soileau	President (1997)
	Glenn Boreman	Board of Directors Member (1997–1999)
	James Harvey	Board of Directors Member (2001–2003)
	Kathleen Richardson	Board of Directors Member (2012–2015)
IEEE photonics SOCIETY	Shin-Tson Wu	Board of Govenors (2003–present)
	Peter Delfyett	Board of Govenors (2000–2002)
	Jim Moharam	Vice-President (1997–1999)
	Kathleen Richardson	Board of Directors Member (2012–2015)
Laser Institute of America — Laser Applications and Safety	Michael Bass	President (1988)
	Michael Bass	Board of Directors Member (1985–1989)
	Aravinda Kar	Board of Directors Member (2005)
	Bahaa Saleh	Board of Directors Member (2010–2012)
	Eric Van Stryland	Board of Directors Member (1992–1994)
National Society of Black Physicists	Peter Delfyett	President (2008–2011)
The American Ceramic Society www.ceramics.org	Kathleen Richardson	Board of Directors Member (2008-2015)
	Kathleen Richardson	President (2014-2015)
National Institute of Ceramic Engineers (NICE)	Kathleen Richardson	President (2008–2009)
APS	Peter Delfyett	Vice-Chair (2015- present)

Journal Editors & Associate Editors

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
Optics Communications (2011–2012)	Pieter Kik
Optical Materials Express (2010–present)	David Hagan
Journal of the Optical Society of America A (1991–1997)	Bahaa Saleh
Advances in Optics & Photonics (2008–present)	Bahaa Saleh
IEEE/OSA Journal of Display Technology (2004–2008)	Shin-Tson Wu
IEEE Journal of Quantum Electronics Lawrence Shah	Lawrence Shah

Associate/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
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
Applied Optics (2008–present)	Axel Schülzgen
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

Authors & Editors of Books

Michael Bass,

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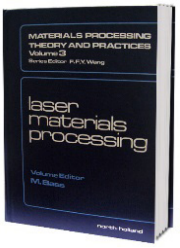

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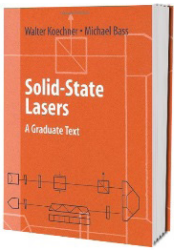

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Vol. II: *Design, Fabrication and Testing, Sources and Detectors, Radiometry and Photometry*.
Vol. III: *Vision and Vision Optics*.
Vol. IV: *Optical Properties of Materials, Nonlinear Optics, and Quantum Optics*.
Vol. V: *Atmospheric Optics, Modulators, Fiber Optics, X-Ray and Neutron Optics*.

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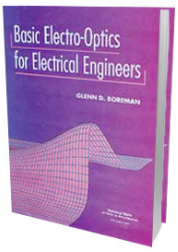

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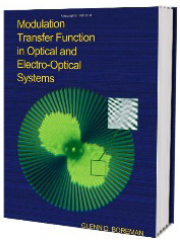

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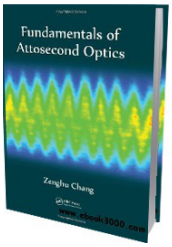

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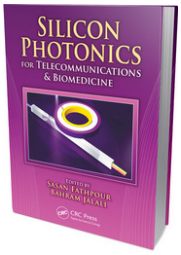

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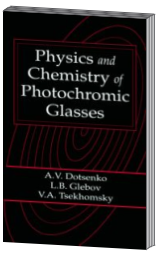

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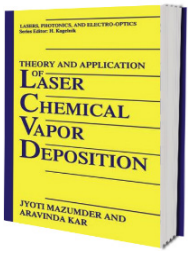

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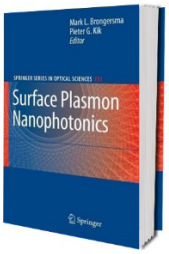

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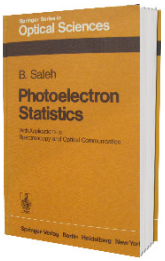

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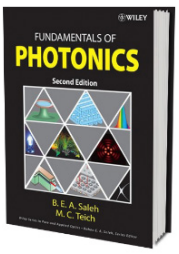

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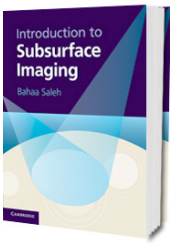

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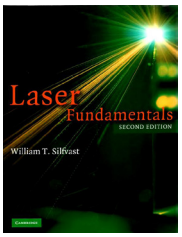

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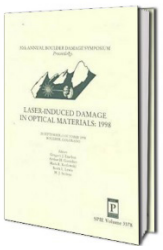

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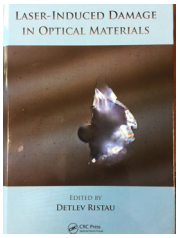

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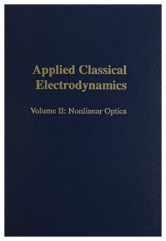

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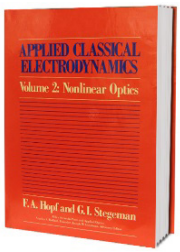

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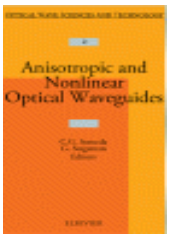

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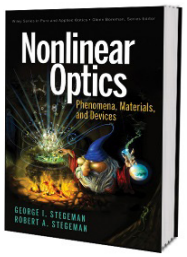

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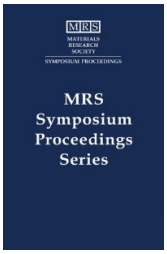

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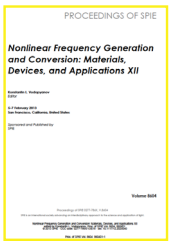

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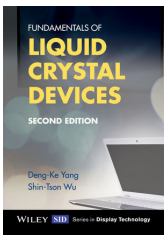

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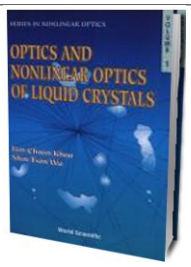

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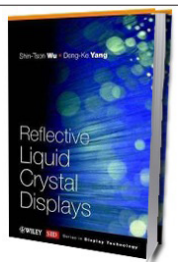

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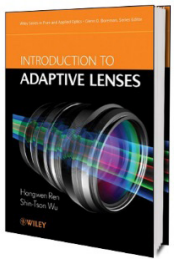

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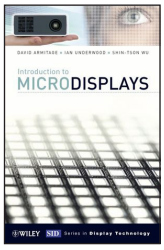

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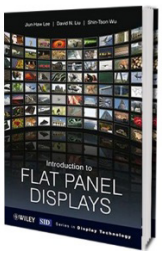

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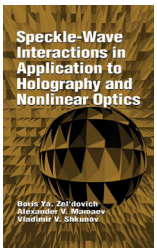

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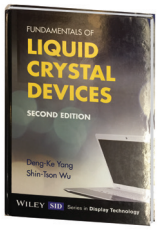


Faculty Awards & Honors 2015

National/International

Conference Chair SID Annual Meeting	Shintson Wu
Conference Chair FIO	David Hagan
Senior Member SPIE	Stephen Kuebler
Fellow of the National Academy of Inventors	Guifang Li
Fellow of AAAS	Martin Richardson

University

Teaching Incentive Program Award (College Level)	Guifang Li
Research Incentive Award	Ayman Abouraddy
Research Incentive Award (College Level)	Demetrios Christodoulides
Excellence in Graduate Teaching Award (College level)	Jim Moharam
Excellence in Research Award	Zenghu Chang
Excellence in Research Award (College level)	Axel Schulzgen & Zenghu Chang

1.2 Research Staff

Senior Research Scientists

Ivan Divliansky (Prof. Glebov's group)
Sabine Freisem (Prof. Deppe's group)
Ilya Mingareev (Prof. M. Richardson's group)
George Venus (Prof. Glebov's group)
Scott Webster (Groups of Profs. Abouraddy, Hagan, Van Stryland)

Research Scientists

Jose Enrique Antonio Lopez (Profs. Amezcua/Schulzgen group)
Catia Bernabini (Prof. Schulzgen's group)
Karima Chamma (Profs. Glebov/K. Richardson group)
Ying Chen (Prof. Bass' group)
Michael Chini (Prof. M. Richardson's group)
Larissa Glebova (Prof. Glebov's group)
Qi Hong (Prof. Wu's group)
Joshua Kaufman (Prof. Abouraddy's group)
Majid Masnavi (Prof. M. Richardson's group)
Devon McClane (Profs. Glebov/K. Richardson group)
Sergiy Mokhov (Prof. Glebov's group)
Andrey Muraviev (Prof. Vodopyanov's group)
Carlo Panto (Prof. K Richardson's group)
Homaira Parchamy Araghy (Prof. M. Richardson's group)
Payam Rabiei (Prof. Fathpour's group)
Jennifer Reed (Profs. Hagan/Van Stryland group)
Edris Sarailou (Prof. Delfyett's group)
Soroush Shabahang (Prof. Abouraddy's group)
Hong Shu (Prof. Bass' group)
Vadim Smirnov (Prof. Glebov's group)
Sergey Sukhov (Prof. Dogariu's group)
Guangming Tao (Prof. Abouraddy's group)
Seyfollah Toroghi (Profs. Fathpour/Kik group)
Guowei Zhao (Prof. Deppe's group)

Post-doctoral Research Associate

Nicholas Barbieri (Prof. M. Richardson's group)
Shi Chen (Prof. Gaume's group)
Jason Lonergan (Prof. K. Richardson's group)
Himansu Pattanaik (Profs. Hagan/Van Stryland group)
Casey Schwarz (Prof. K. Richardson's group)
Charmayne Smith (Prof. K. Richardson's group)
Viktor Smolski (Prof. Vodopyanov's group)
Akbar Ali Syed (Profs. Hagan/Van Stryland group)

Research Associate

Helene Mingareev (Prof. Glebov's group)

Visiting Research Scientists

Rodrigo Acuna Herrera (Profs. Hagan/Van Stryland group)
Ayman Mokhtar Ahmed (Prof. M. Richardson's group)
Mohammed Al-Mumin (Prof. Li's group)
Nejmettin Avci (Prof. Wu's group)
Mykhailo Bondar (Profs. Hagan/Van Stryland group)
Ju Cai (Prof. Li's group)
Jose Hipolito Garcia-Gracia (Prof. Khajavikhan's group)
Shug-June Hwang (Prof. Wu's group)
Tamer Mohamed Kashef (Prof. M. Richardson's group)
Seung Kwan Kim (Prof. Schulzgen's group)
Jinsong Li (Prof. Wu's group)
Juhao Li (Prof. Li's group)
Yongliang Li (Prof. Bass's group)
Yan Liu (Prof. Li's group)
Christos Markos (Prof. Abouraddy's group)
Partha Mukhopadjyay (Prof. Schoenfeld's group)
Rajesh Sharma (Profs. Hagan/Van Stryland group)
Hongjun Shen (Prof. Christodoulides's group)
Xiaoyan Shi (Prof. Wu's group)
Hongcheng Wang (Prof. Christodoulides's group)
Jiwei Wang (Prof. Wu's group)
He Wen (Prof. Li's group)
Xinghua Yang (Prof. Abouraddy's group)
Hongjun Zheng (Prof. Li's group)
Ruilin Zheng (Prof. Abouraddy's group)

Lab Technicians

Arthur Freeman (Prof. M. Richardson's group)

Senior Electrical Engineer

Somsak (Tony) Teerawattanasook (M. Richardson's group)

Special Assistants

Dr. James Pearson

Special Consultant

jpearson@creol.ucf.edu
(407) 823-6858

Dr. C. Martin Stickley

Special Assistant to the Vice President, Research and Commercialization

stickley@creol.ucf.edu
(407) 628-2514

1.3 Administrative Staff

Anne Marie Beary
Receptionist
Anne.Beary@ucf.edu

Alexander Boyd
Student Assistant
alexboyd540@knights.ucf.edu

Gail Drabczuk
Coordinator, Administrative Services
gaild@creol.ucf.edu

Deon Frank
Computer Support
dfrank@creol.ucf.edu

Rachel Franzetta
Senior Admissions Specialist
rfranzet@creol.ucf.edu

Michael Heeke
Office Assistant
Mike.heeke@creol.ucf.edu

Maria Lopes
Travel Coordinator
mlopes@creol.ucf.edu

Mike McKee
Associate Director,
Academic Support Services
mmckee@creol.ucf.edu

Tavis McLelland
Fiscal Assistant
tavis@creol.ucf.edu

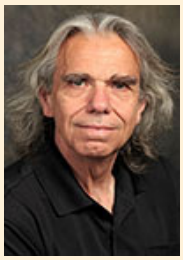
Alma Montelongo
Program Assistant
amontelongo@ucf.edu

Vicky Ortiz
Research Programs Coordinator
vsortiz@creol.ucf.edu

Amy Perry
Coordinator, Administrative Services
aperry@creol.ucf.edu

Veronica Peters
Student Assistant
Veronica.Peters@creol.ucf.edu

Matthew Petrone
Purchasing Office Manager
mpetrone@creol.ucf.edu



James Ross
Assistant in Development
Engineering
jross@creol.ucf.edu

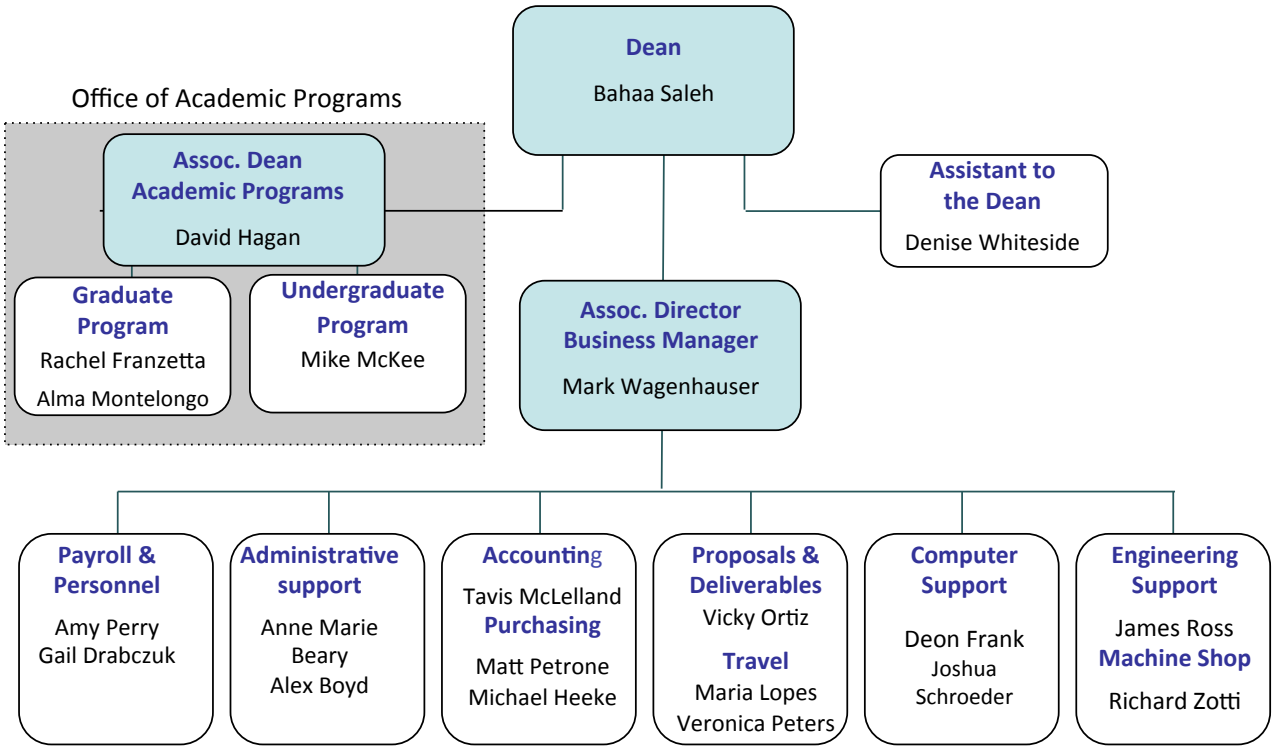
Joshua Schroeder
Computer Support Manager
jschroeder@creol.ucf.edu

Mark C. Wagenhauser
Associate Director/Business
Manager
markw@creol.ucf.edu

Denise Whiteside
Assistant to the Dean
denise@creol.ucf.edu

Richard Zotti
Engineer
rzotti@creol.ucf.edu

Organization Chart



CREOL's Business Manager, Mark Wagenhauser, is the 2015 winner of the Gabor Award. The Gabor Award, which is sponsored by The GABOR Agency, was established to recognize and reward the outstanding job performance of a selected Administrative & Professional (A&P) employee.

2. Academic Programs

2.1 Undergraduate Program

The Bachelor of Science in Photonic Science and Engineering (PSE) is continuing its growth. At the end of the Fall 2015 semester, enrollment in the program was nearly 100 students. Half of these students are in pending status, still needing to complete calculus and physics courses prior to declaring the major. This is an increase from 67 students at this time last year.

In Spring 2015, Andrew Kirk became the program's first graduate, followed by Sean Diamond in Fall 2015. Both accepted job offers prior to graduation.

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 only one of 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 1600 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 33,000 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 40 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 bi-weekly basis to evaluate coursework and plan for eventual ABET accreditation. Accreditation is not awarded until after the first cohort of students graduate in 2015. A second joint committee with CECS meets twice a year to ensure successful collaboration and program progress. Also meeting two times per year is the Advisory Board who advises the program on various needs that will prepare students for the workforce.

In 2015, we added the final set of electives to the slate of courses offered; Optics and Photonics design was taught by Dr. Sean Pang in the spring. Dr. Aristide Dogariu taught Biophotonics in the fall.

Recruitment continues through various organizations. In 2015, presentations were made to local state colleges and high schools. COP also promotes the program at Wekiva High School, which has a photonics magnet program with nearly 100 students. Promotional materials and presentations have been made available for teachers to raise awareness of the program with targeted campaigns to schools where there has historically been a significant number of students majoring in engineering. Promotional materials were also distributed at the Florida Association of Science Teachers conference held in Tallahassee in late October.

Photonics Major and Capstone	31
OSE 3052 Fundamentals of Optics & Photonics	3
OSE 3052L Fundamentals of Optics & Photonics Lab	1
OSE 3053 EM Waves for Photonics	3
OSE 4520 Laser Engineering	3
OSE 4520L Laser Engineering Lab	1
OSE 4410 Optoelectronics	3
OSE 4410L Optoelectronics Lab	1
OSE 4830 Imaging & Display	3
OSE 4830L Imaging & Display Lab	1
OSE 4470 Fiber Optic Communications	3
OSE 4470L Fiber Optic Communications Lab	1
OSE 4930 Frontiers in Photonics	2
OSE 4951 Senior Design I	3
OSE 4952 Senior Design II	3

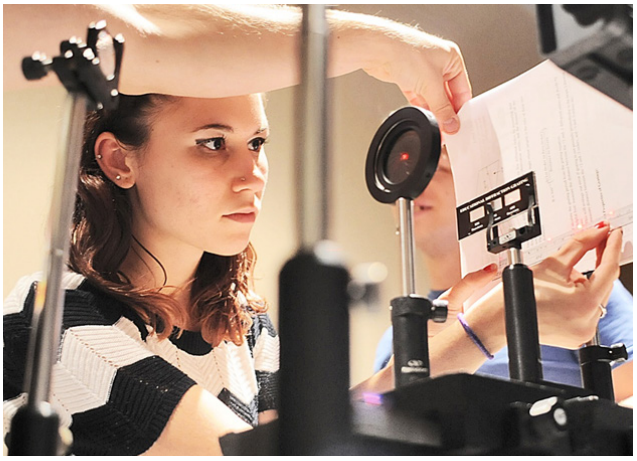
Restrictive Electives	9
OSE 4421 Biophotonics	3
OSE 4240 Optics & Photonics Design	3
OSE 4720 Visual Optics	3
OSE 5312 Light Matter Interaction	3
OSE/EEL/PHY Approved Course	3
or Math/Eng/Sci (max 6)	6

Andrew Kirk, second from left with his parents and Dr. Bahaa Saleh after his graduation in Spring 2015

Scholarship Funds

The following scholarship funds have been established in support of students in the BS-PSE program:

- UCF Research Foundation Photonics Scholarship: a fully-funded $50K endowment
- Cheryl & MJ Soileau Scholarship: a fully-funded $20K endowment for "first in their family in college" students
- CREOL Scholarship: $50K endowment with a current value of $10K
- Karl H. Guenther Endowed Scholarship: $10K endowment
- Northrop Grumman: provides $4.5K annual to BS-PSE students



2.2 Graduate Programs

The College has a strong focus on education at the MS and PhD levels through both coursework and research. Our graduates are highly educated and well prepared for the modern-day work force and consequently they are highly sought after in both the private sector and in top research universities. We also contribute to the undergraduate teaching mission of the university by teaching optics and photonics courses for undergraduates in other programs.

Course and Program Development

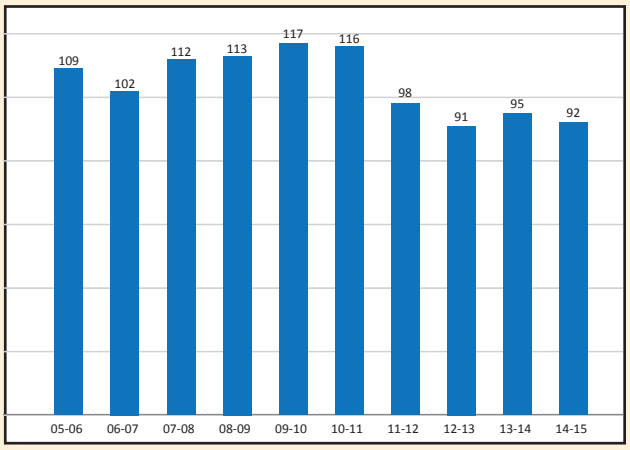
After significant changes to the MS program in 2013-14, there were no major changes made to our graduate programs in 2014-15. Three new courses were introduced. These were OSE 6416 Organic Photonics, OSE 6447 Attosecond Optics, and OSE 6474 Optical Communications Systems. The title of OSE 6445 was changed to Fundamentals of Ultrafast Optics from High Speed Photonics.

Graduate Recruitment and Enrollment

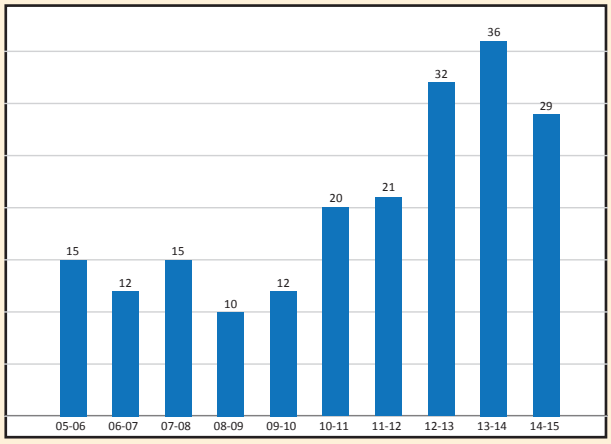
Enrollment in the PhD program in AY 2014-2015 is similar to the last four years. The average prior to 2011 was higher, but was reduced in that year due to a combination of a downturn in funding which resulted in a small student intake in 2011, and a decrease in the time to graduation that was initiated in 2010/2011. Funding and enrollment has increased in the past two years and we expect this will translate to an increase in PhD enrollment in future years.

The MS enrollment continues to experience a growth trend, with 29 students in AY 2014-2015. This is a result of an effort to increase the number of self-funded MS students. The average enrollment from 2005 to 2011 was 15 students, and the average between 2011 to 2014 is 32 students.

A combined total of 31 new students (21 Ph.D. and 10 MS) enrolled in AY 2014-15.



History of PhD Enrollment since 2005



History of MS Enrollment since 2005

** In these charts the year 14-15 accounts for Summer 14, Fall 14, and Spring 15.*

The GRE scores of incoming students are shown below. The average quantitative and verbal scores have increased slightly over the last five years. Overall, we received 303 pre-applications and 188 full applications to the graduate programs for the Fall 2015 Term. The average number of pre-applications and full graduate applications received for the last five years is 342 and 202, respectively. This indicates a slight decline in the applications, particularly from international students. Our admission rate for female students grew last year, from and average of 10% per year over the last five years to 13% in AY 2014-2015

		New Matriculants				Fellowships & Scholarships			
		Male	Female	FT	PT	CREOL Fellow	UCF Award*	UCF Trustee	UCF Dean
PhD	US	7	1	7	1	4	0	0	0
	Intl	10	3	13	0	12	0	0	4
MS	US	2	0	2	0	0	0	0	0
	Intl	8	0	8	0	0	0	0	0
Total New Students		31							

New matriculants and scholarships for FY 2014-15 (Fall 14 - Summer 15). UCF Awards are from the following endowments: Northrop Grumman, Schwartz, Suchoski, Frances Townes

During the last five years, ETS modified the GRE exam extensively, making it difficult to analyze the Quantitative scores. Using the Percentile Ranking rather than the exam scores provided a comparative analysis that yielded the analytic information needed. The mean of 87.3% for AY 2014-2015 is higher than the five year average of 83.6% Percentile Ranking for the Quantitative Scores. The 87.3% is the highest Mean Percentile Ranking achieved over the last five years. Overall, we received 431 pre-applications and 219 full applications to the graduate programs for the AY 2014-2015. The pre-application is a preselecting tool run through our own 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

		Quantitative	%	Verbal	%	Analytic Writing	%
PhD	US	159	73%	156	67%	3.9	51%
	Intl	165	90%	151	49%	3.3	27%
MS	US	168	95%	162.5	90%	3.8	46%
	Intl	166	91%	147	33%	2.9	14%

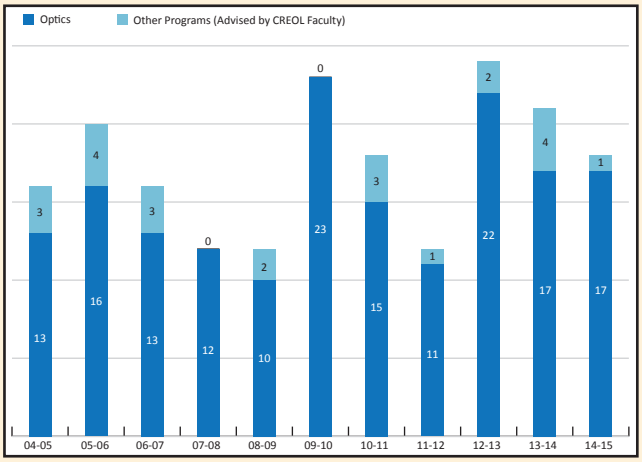
AY2014-15 Mean GRE Scores (Fall Admissions)

Mean		164		154		3.5	

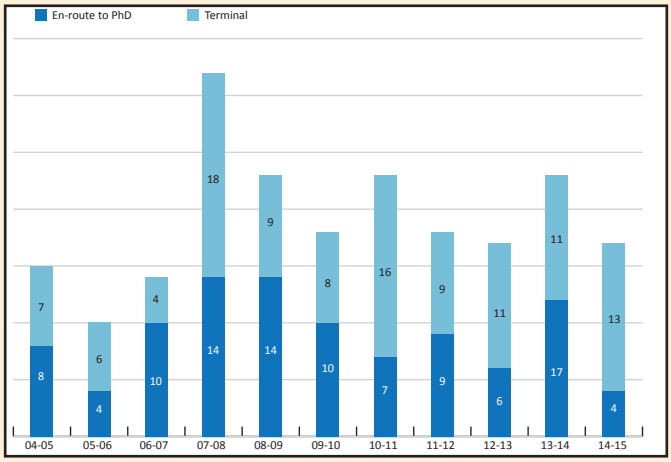
Degrees Granted

As shown in the chart below, the 18 PhD degrees awarded were similar to the recent average. A total of 192 PhD degrees, including optics PhDs and other PhD degrees supervised by CREOL faculty, were awarded during the 10 year period from 2004 to 2015, With the recent hiring of new faculty and growth in admissions, we anticipate the rate of PhD awards to increase in future years.

The number of MS degrees awarded in academic year 2014-2015 (17) is roughly similar to previous years. The total number of degrees awarded during the 10 year period from 2004 to 2015 is 210 and the average is 19 per year. With the increase in incoming MS students, this number is expected to increase.



PhD degrees awarded to students in the Optics & Photonics program and students in other UCF programs with College of Optics & Photonics advisors.



MS degrees awarded to students leaving with an MS degree (Terminal MS) and students continuing on to the PhD degree (En-route to PhD).

** In these charts the year 14-15 accounts for Summer 14, Fall 14, and Spring 15.*

Ph.D. Dissertations

Degrees granted in academic year 2015 (Fall 2014 – Summer 2015)

Student	Program	Advisor	Dissertation Title
Brian Anderson	Optics & Photonics	Leonid Glebov	Transverse Mode Selection and Brightness Enhancement in Laser Resonators by Means of Volume Bragg Gratings
Marcus Bagnell	Optics & Photonics	Peter Delfyett	Photonic Filtering for Applications in Microwave Generation and Metrology
Sharad Bhooplapur	Optics & Photonics	Peter Delfyett	Injection-Locked Vertical Cavity Surface Emitting Lasers (VCSELs) for Optical Arbitrary Waveform Generation
Panit Chantharasupawong	Optics & Photonics	Jayan Thomas	Nano and nanostructured materials for optical applications
Jeffrey D'Archangel	Optics & Photonics	Winston Schoenfeld & Glenn Boreman	Large Area, Conformal Infrared Frequency Selective Surfaces
Kristopher Davis	Optics & Photonics	Winston Schoenfeld	Atmospheric Pressure Chemical Vapor Deposition of Functional Oxide Materials for Crystalline Silicon Solar Cells
Trenton Ensley	Optics & Photonics	David Hagan & Eric Van Stryland	White Light Continuum for Broadband Nonlinear Spectroscopy
Sihui He	Optics & Photonics	Shin-Tson Wu	Liquid Crystal-Based Biosensors for the Detection of Bile Acids
Sergiy Kaim	Physics	Boris Zeldovich	Theoretical Study of Laser Beam Quality and Pulse Shaping in Schemes with Volume Bragg Gratings
Khan Lim	Optics & Photonics	Martin Richardson	Laser Filamentation - Beyond Self-focusing and Plasma Defocusing
Zhenyue Luo	Optics & Photonics	Shin-Tson Wu	High Efficiency and Wide Color Gamut Liquid Crystal Displays
Lane Martin	Optics & Photonics	Bahaa Saleh	Entangled Photon Pairs in Disordered Photonic Lattices
Mohammad-Ali Miri	Optics & Photonics	Demetrios Christodoulides	Parity-Time and Supersymmetry in Optics
Himansu Pattanaik	Optics & Photonics	David Hagan & Eric Van Stryland	Two-Photon Absorption in Bulk Semiconductors and Quantum Well Structures and its Applications
Matthew Reichert	Optics & Photonics	David Hagan &Eric Van Stryland	Nonlinear Optical Response of Simple Molecules and Two-Photon Semiconductor Lasers
Edris Sarailou	Optics & Photonics	Peter Delfyett	True Linearized Intensity Modulation for Photonic Analog to Digital Conversion Using an Injection-Locked Mode-Locked Laser
Seyfollah Toroghi	Optics & Photonics	Pieter Kik	Cascaded Plasmon Resonances for Enhanced Nonlinear Optical Response
Cen Xia	Optics & Photonics	Guifang Li	Optical Fibers for Space-Division Multiplexed Transmission and Networking

Student Scholarships and Awards

National Scholarships, Grants, and Awards (2015)

Scholarships

Daming Xu, SPIE DJ Lovell Scholarship, IEEE Orlando Section: Outstanding Graduate Student Award, IEEE Graduate Scholarship

Evan Hale, Joshua Bradford, Alex Sincore, DEPS Scholarship award

Fellowships

Jennifer Kassel, NSF GRFP fellowship

Daming Xu, Graduate Dean's Dissertation Completion Fellowship

Best Papers or Posters

Christos Markos (postdoctoral researcher) 2015 OSA Outstanding Reviewer Recognition

Mohammad-Ali Miri, 2014-2015 university award for Outstanding Dissertation.

Zhenyue Luo, Haiwei Chen, Yating Gao, SID'15 Distinguished Paper award

Travel Grants (2015)

Haiwei Chen, Yating Gao, Sihui He, Haowen Liang, Zhenyue Luo, Fenglin Peng, Daming Xu, Jiamin Yuan and Ruidong Zhu, SID Travel Grants

Alex Sincore, SPIE Officer Travel Grant

Other Awards

Casey Schwartz (postdoctoral researcher) 2015 Postdoc to Faculty (P2F) American Chemical Society (ACS) workshop invitee

High School student, Catherine Li, Third Place Medal of Distinction for Innovation-Intel Science Talent Search competition & selected as a finalist for the Intel 2015 Science Talent Search.

UCF Fellowships and Awards (AY 2014-2015)

Graduate Research Excellence Fellowship

Mohammad Miri

Amy Van Newkirk

Zhenyue Luo

Eric Cunningham

Anthony Klee

Matthew Reichert

Cen Xia

Benjamin Webb

Chatdanai Lumdee

Trenton Ensley

Kumel Kagalwala

Marcus Bagnell

Graduate Research Forum Poster Award

Amy Van NewKirk

Daniel Franklin

Javaneh Boroumand

UCF College of Graduate Studies Presentation Fellowship

Andy Buff

Laura Sisken

College of Optics & Photonics Awards (2014)

Jeffery Chiles, College of Optics & Photonics Student of The Year Award

Mohammad-Ali Miri, finalist, 2015 Student of the Year Award

Cen Xia, finalist, 2015 Student of the Year Award

Amy Van Newkirk & Matthew Reichert, 2015 Best Poster Award

Undergraduate

Christopher Beck, UCF Founders' Award for Exceptional Ability and Performance

Jonathan Brown, Wilfredo Ortiz, Josie Lorenzo, Northup Grumman Scholarship

Daniel Batista, Burnett Research Scholars fellowship

Danielle Harper, first place winner at the UCF SURE (Showcase of Undergraduate Research Excellence)

Burdley Colas, Distinguished Undergraduate Researcher Award, Honorable Mention at the UCF SURE (Showcase of Undergraduate Research Excellence)

Ahmad Azim, NSF funded Career Advancement Mentoring Program for Young Entrepreneur and Scholars (CAMP-YES)

Ryan Sapia, UCF Research and Mentoring Program (RAMP) grant award

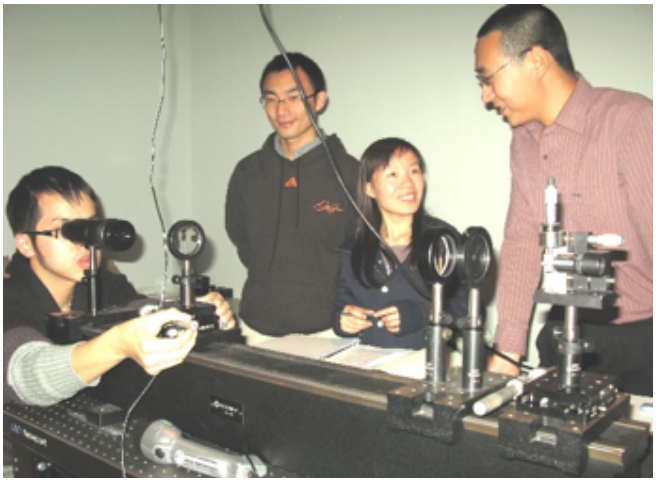
Courses Taught

		Fall 2014	Spring 2015	Summer 2015
Core Graduate Courses				
OSE 5203	Geometrical Optics and Imaging Systems	Moharam		
OSE 5312	Light Matter Interaction		Abouraddy	
OSE 6111	Optical Wave Propagation	Moharam		
OSE 6115	Interference, Diffraction, and Coherence		Dogariu	
OSE 6432	Guided Waves and Optoelectronics		Moharam	
OSE 6525	Laser Engineering	Khajavikhan		
Other OSE Graduate Courses				
OSE 5041	Introduction to Wave Optics	Wu		
OSE 5414	Fundamentals of Optoelectronics	LiKamWa		
OSE 6120	Theoretical Foundations of Optics	Zeldovich		
OSE 6265	Optical Systems Design			
OSE 6319	Optical Waves and Materials			Zeldovich
OSE 6334	Nonlinear Optics		Van Stryland	
OSE 6335	Nonlinear Guided Wave Optics	Christodoulides		
OSE 6349	Applied Quantum Mechanics for Optics	Abouraddy		
OSE 6421	Integrated Photonics		Fathpour	
OSE 6445	High Speed Photonics	Delfyett		
OSE 6455C	Photonics Laboratory	Li		
OSE 6474	Optical Communications Systems			
OSE 6526C	Laser Engineering Laboratory		Vodopyanov	Vodopyanov
OSE 6615L	Optoelectronic Device Fabrication Laboratory	Chanda	Chanda	
OSE 6820	Flat Panel Displays			
OSE 6938Y	ST: Photonic Polymer Materials			
Non-OSE Courses				
ISC 6416	ST: History of Physical Sciences and Cultural Connections		Bass	
EMA 4223	Fundamentals of Mechanical Behavior of Materials		Gaume	
EMA 6605	Materials Processing Techniques	Kar		
EML 5152	Intermediate Heat Transfer		Kar	
EEL 4440	Optical Engineering	Hagan		
Undergraduate Courses				
OSE 3052	Introduction to Photonics	Hagan		
OSE 3052L	Introduction to Photonics Laboratory	Schulzgen		
OSE 3052R	Introduction to Photonics (Recitation)	Moharam	Moharam	
OSE 3053	Electromagnetic Waves for Photonics		Moharam	
OSE 4240	Optics and Photonics Design		Pang	
OSE 4410	Optoelectronics		Khajavikhan	
OSE 4410L	Optoelectronics Laboratory		Kar	
OSE 4470	Fiber-Optic Communications	Fathpour		
OSE 4470L	Fiber-Optic Communications Laboratory	Li		
OSE 4520	Laser Engineering		Delfyett	
OSE 4520L	Laser Engineering Laboratory		LiKamWa	
OSE 4830	Imaging and Display	Saleh		
OSE 4830L	Imaging and Display Laboratory	Dogariu		
OSE 4930	Frontiers of Optics and Photonics	Kuebler		
OSE 4951	Senior Design I	LiKamWa		
OSE 4952	Senior Design II		LiKamWa	

Instructional Laboratories

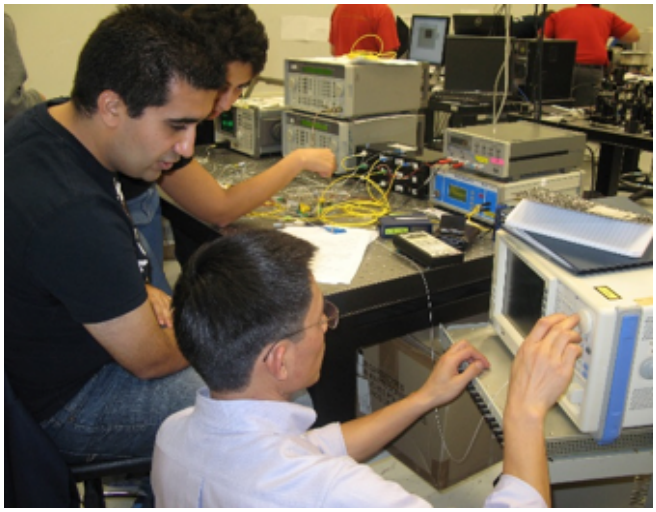
OSE 6234C Applied Optics Laboratory

Laboratory techniques for observing optical phenomena and quantitative experimental study of geometrical optics, optical interferometry, diffraction, and image processing. Prerequisite: Graduate standing and OSE 5203 or consent of the instructor.



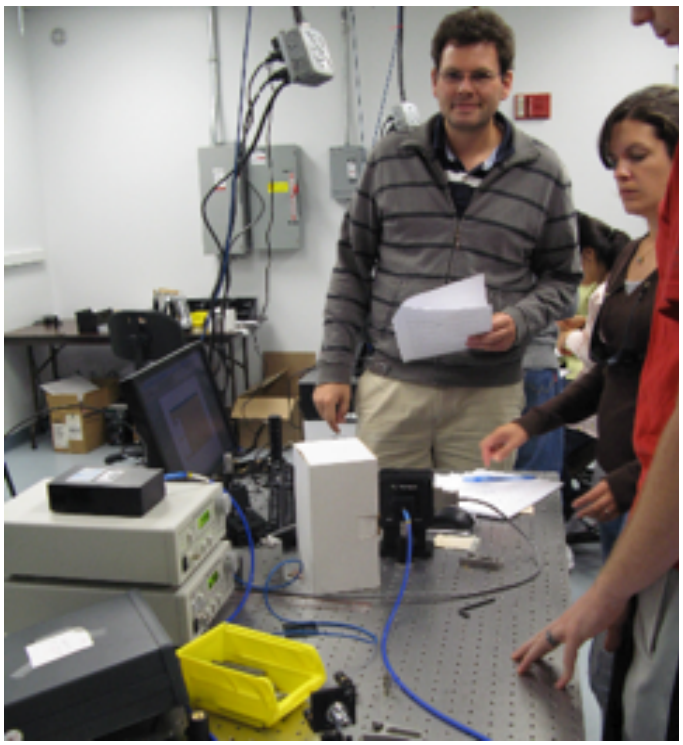
OSE 6455C Photonics Laboratory

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. Prerequisite Course: Graduate standing and OSE 6432 or consent of the instructor.



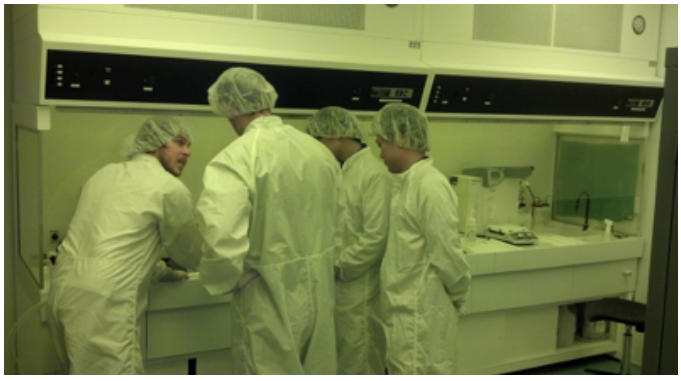
OSE 6526C Laser Engineering Laboratory

Designing and device implementation of diode pumped solidstate lasers, nonlinear frequency conversion, Q-switching, mode locking, and pulse second harmonic generation. Prerequisite Course: Graduate standing and OSE 6525 or consent of the instructor.



OSE 6615L 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.



Colloquia and Seminars

1/12/2015	Ole Bang Technical University of Denmark (DTU),	Activities in the Fiber Sensors & Supercontinuum Group at DTU Fotonik
1/13/2015	J. P. Palastro Icarus Research, NRL	Modeling of ultrashort pulse laser-matter interactions
1/21/2015	Himansu Pattanaik CREOL-UCF	IR detection and IR imaging in wide-gap semiconductors using extremely nondegenerate two photon absorption
	Mahtab Khan Physics-UCF	2D fermionic Hong-Ou-Mandel interference with massless Dirac fermions (OSA Graduate Research Symposium)
1/22/2015	John Rogers Seitz Materials Research Laboratory	Soft Optoelectronics: From Brain Interfaces to Fly's Eye Cameras. (NSTC/CREOL Distinguished Seminar Series)
1/22/2015	Jeffrey Chiles	Hybrid Integrated Photonic Platforms and Devices
	Mohammad-Ali Miri	Discrete Symmetries in Optics
	Cen Xia CREOL-UCF	Space-Division Multiplexed Transmission and Networking (CREOL Student of the Year Finals 2015)
1/29/2015	Pao-Tai Lin MIT	See Chem-Bio Molecules in New Light: Mid-Infrared Materials & Nanophotonics (OSA Student Chapter Seminar Series)
1/30/2015	Jacqueline A. Johnson University of Tennessee Space Institute	Gamma-Ray Computed Radiography using a Fluorochlorozirconate Glass-Ceramic Storage Phosphor Plate
2/20/2015	Qiong-Hua Wang Sichuan University, Chengdu, China	Glasses-free 3D Displays (SID/IEEE Joint Student Chapter Seminar Series)
2/23/2015	Jean-luc Doumont	The 3 Laws of Communication. (OSA, SPIE and IEEE Joint Student Chapter Seminar Series)
3/06/2015	Ling Wang Kent State University	Near Infrared-Light Directing Chiral Liquid Crystal Superstructures: From 1D to 3D (SID Student Chapter Seminar Series)
3/06/2015	Peter G. Schunemann BAE Systems, Inc.	New Materials for Mid-Infrared Nonlinear Optics
3/12/2015	Jeff Hecht Science and technology writer	Evolving Lasers to Solve Problems
3/16/2015	Gregory Eskridge Teledyne Oil and Gas	Optical Connectivity Solutions for Sub-Sea Systems (The Society of Optics Students (SOS) Seminar Series)
3/17/2015	Paul Braun UIUC	Three Dimensionally Structured Materials for Energy Storage and Light Harvesting (NSTC/AMPAC/CREOL Distinguished Seminar Series)
3/17/2015	Dan Marom Hebrew University, Israel	Switching technologies for spatially and spectrally flexible optical networks (IEEE Student Chapter Seminar Series)
3/30/2015	Xingjie Ni University of California, Berkeley	Metasurfaces for Planar Photonics and Spin Optoelectronics
4/02/2015	Ardavan Oskooi U of M	Leveraging Advances in Computational Electrodynamics to Enable New Kinds of Nanophotonic Device Design- from Enhanced Solar Cells to Energy-Efficient Displays and Solid-State Lighting
4/09/2015	Parag Deotare ONELab at MIT	Opto-Excitonic Circuits: Processing Light with Matter
4/15/2015	Jay Choi U of M	Metallic Laser Additive Manufacturing
4/15/2015	Sudeep Jung Pandey	Fabrication of titanium oxide Magneli phase nanoceramics for thermoelectric applications
	Zeinab "Zahoora" Sanjabi Eznaveh CREOL-UCF	Thermal modal instabilities in high power fiber amplifiers (OSA Graduate Research Symposium)

4/16/2015	J.G. Tischler NRL	Beating the Diffraction Limit with Polar Dielectrics: Employing Surface Phonon Polaritons in Low Loss Optical Antennas
4/17/2015	Ilya Mingareev CREOL-UCF	Towards predictive laser additive manufacturing of advanced lightweight materials and components
4/20/2015	Wei-Chuan Shih University of Houston	Light-based molecular sensing and imaging for translational biophotonics
4/22/2015	Kosmas L. Tsakmakidis UC Berkeley	Broadband Slow and Stopped Waves in Nanophotonics, Acoustics and 2D Condensed Matter
4/24/2015	Peter J. Delfyett CREOL-UCF	Lasers - the Light Fantastic (Optics Day Seminar)
4/24/2015	Kathleen Richardson CREOL-UCF	Living the interdisciplinary dream – in a discipline-specific world (SPIE Student Chapter Faculty Talk Series)
5/01/2015	Peter Herman University of Toronto	The magic of nonlinear laser processing: Nanostructuring inside thin films and shaping multi-functional lab-in-fibre (NSTC/AMPAC/CREOL Distinguished Seminar Series)
5/06/2015	Jennifer K. Barton, University of Arizona	Endoscopes for optical coherence imaging and fluorescence spectroscopy: design and applications to cancer imaging (WiLO Student Chapter/CREOL Distinguished Seminar Series)
5/12/2015	Andrea S. S. de Camargo University of São Paulo, São Carlos – SP, Brazil	Fluorophosphate glasses doped with Er3+ and Yb3+: Structural and Photophysical Characterization
5/15/2015	Mathieu Allix CNRS, Orléans, France	Tailoring crystallization in oxide glasses: Application to transparent polycrystalline ceramics and nanostructured glass-ceramics
5/15/2015	John McCloy Washington State University (WSU)	Structure, Optical Properties, and Crystallization in Multicomponent Chalcogenide Glasses
5/21/2015	Sihui He Ashutosh Rao CREOL-UCF	Liquid crystal based biosensors for the detection of bile acids Heterogeneous microring and Mach-Zehnder modulators based on lithium niobate and chalcogenide glassses on silicon (OSA Graduate Research Symposium)
5/22/2015	Vincent Rodriguez Institute of Molecular Science (ISM), University of Bordeaux, Talence, France	What can we learn in glass materials combining conventional infrared and Raman with unconventional hyper-Raman and hyper-Rayleigh techniques?
5/26/2015	Kyle Renshaw Northrop Grumman Corp.	Thin-film Materials for Next-Generation Optoelectronics
5/27/2015	Jiun-Haw Lee National Taiwan University	Improving Solar Cell Efficiency beyond Shockley-Quisser Limit by Singlet Fission—Exciton Dynamics in Rubrene and Tetracene Thin Films (SID & IEEE Student Chapters Seminar)
5/28/2015	Ryan M. Gelfand University of Victoria	Stimulated Raman: Building Better Biosensors, Making Medical Discoveries, and Understanding Fundamental Biophysics
6/01/2015	Kyu Young Han UIUC	Toward opto-biology: Fluorescence nanoscopy, single molecule techniques and RNA imaging probes
6/05/2015	Patrick Koelsch University of Washington	Analysis of Protein Fibers Using Nonlinear Optical Microscopy and Spectroscopy
6/11/2015	M.J. Soileau Research & Commercialization, UCF	A Creole boy goes to CREOL: Many hands make light work (SPIE Faculty Talk Series Seminar)
6/30/2015	Sergio G. Leon-Saval University of Sydney	The Photonic Lantern
7/10/2015	Heike Ebendorff-Heidepriem University of Adelaide, Australia	Pushing the limits in glass properties and structures for laser, sensing and nonlinearity applications
7/24/2015	Nathan Kurz Lockheed Martin Laser Systems	Threshold Power and Fiber Degradation Induced MI in High Power Fiber Amplifiers Based on LMA Fiber
8/07/2015	Ulrike Fuchs Asphericon GmbH	Tutorial on aspheric optics

8/20/2015	Timothy Dwyer Jacquelyn Metzger Wanda McNair-Cartier Homeland Security Investigations	Homeland Security Outreach Program
8/21/2015	Michael Bass CREOL-UCF	The Modern World – We Owe It To Physics (SPIE Student Chapter Faculty Talk Series)
8/28/2015	Aristide Dogariu Eric Van Stryland CREOL/UCF	Introduction to Research at CREOL: Dogariu & VanStryland
9/01/2015	Pieter Kik Shin-Tson Wu CREOL/UCF	Introduction to Research at CREOL: Kik & Wu
9/11/2015	Peter Delfyett Rodrigo Amezcua CREOL/UCF	Introduction to Research at CREOL: Delfyett & Amezcua
9/15/2015	David Hagan Ryan Gelfand CREOL/UCF	Introduction to Research at CREOL: Hagan & Gelfand
9/15/2015	Samuel Sonderegger Attolight AG	Combined continuous and time-resolved cathodoluminescence to study semiconductor structure and defects
9/18/2015	Romain Gaume Axel Schülzgen CREOL-UCF	Introduction to Research at CREOL: Gaume & Schülzgen
9/22/2015	Shuo (Sean) Pang Sasan Fathpour	Introduction to Research at CREOL: Pang & Fathpour
9/25/2015	Lawrence Shah Zenghu Chang CREOL/UCF	Introduction to Research at CREOL: Shah & Chang
10/07/2015	Colin Constant Benn Gleason CREOL/UCF	Controlling diffusion with light Designing Optical Properties in Infrared Glasses (OSA Graduate Research Symposium)
10/23/2015	Michael Bass CREOL/UCF	Tiny neutral ones – neutrinos (SPIE Student Chapter Faculty Talk Series)
10/28/2015	Igor Volkov Jessica Carter UCF	Network & Career Services How to Write the Best Resumes-Improve Your Linkedin Page (SOS Professional Development Presentation)
11/05/2015	Mable Fok University of Georgia	Fill the Needs of Wideband Dynamic Microwave System: From Photonics to Neuromophic
11/09/2015	Chris A. Mack University of Texas	The End of the Semiconductor Industry as We Know It (SPIE Student Chapter Seminar)
11/17/2015	Bahaa Saleh CREOL-UCF	The “Book of Optics”: A Millennium Anniversary (The Society of Optics Students (SOS) Seminar Series)
11/18/2015	Mohammad Umar Piracha CREOL/UCF	Journey through an optics career... from academia to industry (SOS Professional Development Presentation)
11/18/2015	Kortan Ogutman James Anderson CREOL-UCF	Imaging Solar Cells via Photoluminescence Multicore Fiber Lasers (OSA Graduate Research Symposium)
11/24/2015	Wenshan Cai Georgia Tech	Optical Metamaterials: from Linear Responses to Nonlinear Interactions and beyond
12/11/2015	Leonid Glebov CREOL-UCF	Long and Sinuous Way in Optics Research (SPIE Faculty Talk Series Seminar)

Students

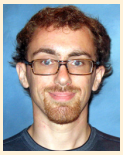
MS Students (AY 2014-2015)

Anand, Sambhav (part time)
Bhalkikar, Abhijeet (part time)
Carboni, Christian, Advisor: Li
Chen, Hao (part time)
Clark, Joseph (part time)
Creekmore, Amy, Advisor: Wu
Gebhardt, Martin, Advisor: Richardson
Hardin, James (part time)
Knebl, Andreas, Advisor: Richardson
Levy, Melissa (part time)
Liu, Sili (part time)
Ma, Zhao (part time)
Maloof, William (part time)
Matz, Gregor, Advisor: Li
Mehta, Naman, Advisor: Schulzgen
Modak, Sushrut, Advisor: Chanda
Mueller, Michael, Advisor: Richardson
Rakes, Colin (part time)
Ryan, Robert, Advisor: Richardson
Schick, Ryan (part time)
Shappard, Todd (part time)
Sun, Yangyang (part time)
Szilagyi, John, Advisor: Richardson
Villinger, Massimo, Advisor: Abouraddy
Vinueza, Emilio (part time)
Xu, Jia, Advisor: Vodopyanov
Zhang, Yansong, Advisor: Deppe
Zhu, Jianxiong (part time)

Ph.D. Students (AY 2014-2015)

Ahmadzadeh Benis, Sepehr, Advisor: Hagan/Van Stryland
Akhlaghi Bouzan, Milad, Advisor: Dogariu
Aleahmad, Parinaz, Advisor: Christodoulides
Alhasan, Sarmad, Advisor: Khajavikhan
Anderson, Brian, Advisor: Glebov
Anderson, James, Advisor: Schulzgen
Bagnell, Marcus, Advisor: Delfyett
Bagnell, Kristina, Advisor: Delfyett
Bakhshi, Sara, Advisor: LiKamWa
Bayat, Mina, Advisor: Delfyett
Bhooplapur, Sharad, Advisor: Delfyett
Bradford, Joshua, Advisor: M. Richardson
Butrimas, Steven (part time)
Chantharasupawong, Panit, Advisor: Thomas
Chen, Haiwei, Advisor: Wu
Chew, Andrew, Advisor: Chang
Chiles, Jeffrey, Advisor: Fathpour
Constant, Colin, Advisor: Dogariu
Cunningham, Eric, Advisor: Chang
Darchangel, Jeffrey, Advisor: Schoenfeld
Davis, Kristopher, Advisor: Schoenfeld
Dhasmana, Nitesh, Advisor: Thomas
Digaum, Jennefir, Advisor: Kuebler
Eftekhar, Mohammad Amin, Advisor: Christodoulides
Ensley, Trenton, Advisor: Hagan/Van Stryland
Fan, Shengli, Advisor: Li
Gao, Yating, Advisor: Wu
Grigorev, Roman, Advisor: Delfyett
Guzman Sepulveda, Jose Rafael, Advisor: Dogariu
Hale, Evan, Advisor: Glebov
Hassan, Absar, Advisor: Christodoulides
Hayenga, William, Advisor: Khajavikhan
He, Sihui, Advisor: Wu
He, Juan, Advisor: Wu
Hodaei Esfahani, Seyed Hossein, Advisor: Khajavikhan
Huang, Bin, Advisor: Li
Husam Eldeen, Hayder, Advisor: Li
Jang, Yuseong, Advisor: M. Richardson
Jeon, Cheonha, Advisor: M. Richardson
Kagalwala, Kumel, Advisor: Saleh
Kajorndejnukul, Veerachart, Advisor: Dogariu
Kazemi Jahromi, Ali, Advisor: Abouraddy
Kepler, Daniel, Advisor: M. Richardson
Klee, Anthony, Advisor: Delfyett
Kompan, Fedor, Advisor: Gelbov
Kondakci, Hasan, Advisor: Saleh
Lane, Jesse, Advisor: M. Richardson
Larson, Walker, Advisor: Abouraddy
Lee, Yun Han, Advisor: Wu
Li, Mingxin, Advisor: Deppe
Li, Jie, Advisor: Chang
Lim, Khan, Advisor: M. Richardson
Liu, Huiyuan, Advisor: Li
Lopez Aviles, Helena, Advisor: Christodoulides
Lumdee, Chatdanai, Advisor: Kik
Luo, Zhenyue, Advisor: Wu
Malinowski, Marcin, Advisor: Fathpour
Martin, Lane, Advisor: Saleh
Mayi Rivas, Jose (part time)
Mills, Matthew, Advisor: Christodoulides
Miri, Mohammad-Ali, Advisor: Christodoulides
Nye, Nicholas, Advisor: Christodoulides
Parto, Midya, Advisor: Christodoulides
Pattanaik, Himansu, Advisor: Hagan/Van Stryland
Peng, Fenglin, Advisor: Wu
Pye, Lorelle, Advisor: Abouraddy
Rao, Ashutosh, Advisor: Fathpour
Reichert, Matthew, Advisor: Hagan/Van Stryland
Roumayah, Patrick, Advisor: M. Richardson
Ru, Qitian, Advisor: Vodopyanov
Sarailou, Edris, Advisor: Delfyett
Sincore, Alex, Advisor: M. Richardson
Sisken, Laura, Advisor: K. Richardson
Strunk, Evelyn, Advisor: Hagan/Van Stryland
Talukder, Javedrouf, Advisor: Delfyett
Tan, Felix, Advisor: Abouraddy
Tan, Guanjun, Advisor: Wu
Tatulian, Adrian, Advisor: Chang
Tofighi, Salimeh, Advisor: Hagan/Van Stryland
Toroghi, Seyfollah, Advisor: Kik
Van Newkirk, Amy, Advisor: Schulzgen
Vazquez-Guardado, Abraham, Advisor: Chanda
Wang, Tiansi, Advisor: Kar
Wang, Ning, Advisor: Li
Wang, Yang, Advisor: Chang
Webb, Benjamin, Advisor: M. Richardson
Wu, Fan, Advisor: Christodoulides
Xia, Cen, Advisor: Li
Xu, Daming, Advisor: Wu
Yang, Xu, Advisor: Deppe
Yuan, Jiamin, Advisor: Wu
Zhao, Peng, Advisor: Hagan/Van Stryland
Zhao, Jian, Advisor: Vodopyanov
Zhu, Ruidong, Advisor: Wu

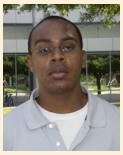
Post-Graduation Employment



Brian Anderson
PhD Optics & Photonics, Summer 2015
Advisor: Dr. Leonid Glebov
Post Doctoral Researcher
Kirtland AF Research Labs, Nevada

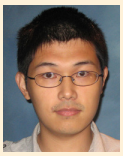
Sharad Bhooplapur
PhD Optics & Photonics, Fall 2014
Advisor: Dr. Peter Delfyett
RET Design Engineer
Intel, Seattle, WA

Jeffrey D'Archangel
PhD Optics & Photonics, Fall 2014
Advisors: Dr. Winston Schoenfeld &
Dr. Glenn Boreman
Optical Scientist
Dept. of the Army



Trenton Ensley
PhD Optics & Photonics, Spring 2015
Advisors: Dr. David Hagan & Dr. Eric Van
Stryland
Post Doctoral Researcher
Army Research Laboratory, Adelphi, MD

Sergiy Kaim
PhD Optics & Photonics, Spring 2015
Advisor: Dr. Boris Zeldovich
Adjunct Professor Physics
Valencia College, Orlando, FL

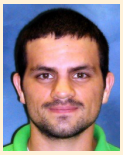


Zhenyue Luo
PhD Optics & Photonics, Summer 2015
Advisor: Dr. Shin-Tson Wu
Optical and Display Engineer
Apple, Inc., San Francisco, California

Mohammad Ali Miri
PhD Optics & Photonics, Fall 2014
Advisor: Dr. Demetrios Christodoulides
Post Doctoral Researcher
University of Texas at Austin

Matthew Reichert
PhD Optics & Photonics, Summer 2015
Advisors: Dr. David Hagan & Dr. Eric Van
Stryland
Post Doctoral Researcher
Princeton University, NJ

Seyfollah Toroghi
PhD Optics & Photonics, Fall 2014
Advisor: Dr. Pieter Kik
Post Doctoral Researcher
CREOL, College of Optics & Photonics



Marcus Bagnell
PhD Optics & Photonics, Fall 2014
Advisor: Dr. Peter Delfyett
Staff Scientist
Booz Allen Hamilton, Washington, D.C.

Panit Chantharasupawong
PhD Optics & Photonics, Spring 2015
Advisor: Dr. Jayan Thomas
undisclosed company, Thailand

Kristopher Davis
PhD Optics & Photonics, Spring 2015
Advisor: Dr. Winston Schoenfeld
Research Engineer
Florida Solar Energy Center (FSEC)

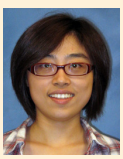
Sihui He
PhD Optics & Photonics, Summer 2015
Advisor: Dr. Shin-Tson Wu
Sr. Optical Engineer
Apple, Inc., Seattle WA

Khan Lim
PhD Optics & Photonics, Fall 2014
Advisor: Dr. Martin Richardson
Sr. Member of Technical Staff
DSO National Laboratory, Singapore

Lane Martin
PhD Optics & Photonics, Fall 2014
Advisor: Dr. Bahaa Saleh
Post Doctoral Researcher
CREOL, College of Optics and Photonics

Himansu Pattanaik
PhD Optics & Photonics, Spring 2015
Advisors: Dr. David Hagan & Dr. Eric Van
Stryland
Post Doctoral Researcher
CREOL, College of Optics and Photonics

Edris Sarailou
PhD Optics & Photonics, Spring 2015
Advisor: Dr. Peter Delfyett
Post Doctoral Researcher
CREOL, College of Optics and Photonics



Cen Xia
PhD Optics & Photonics, Summer 2015
Advisor: Dr. Guifang Li
Sr. Optical System Engineer
Infinera, Sunnyvale, CA

3. Research

The faculty, scientists, and students of the college are engaged in research in areas utilizing radiation at wavelengths extending from millimeter waves to X-rays and covering the basic science and physics of optics and photonics, as well as engineering applications including prototyping development and feasibility studies. They vigorously pursue collaborative work with researchers at other academic institutions worldwide and joint research projects with industry 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: FPCE, TLI, and iFAST.

3.1 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 (TLI)

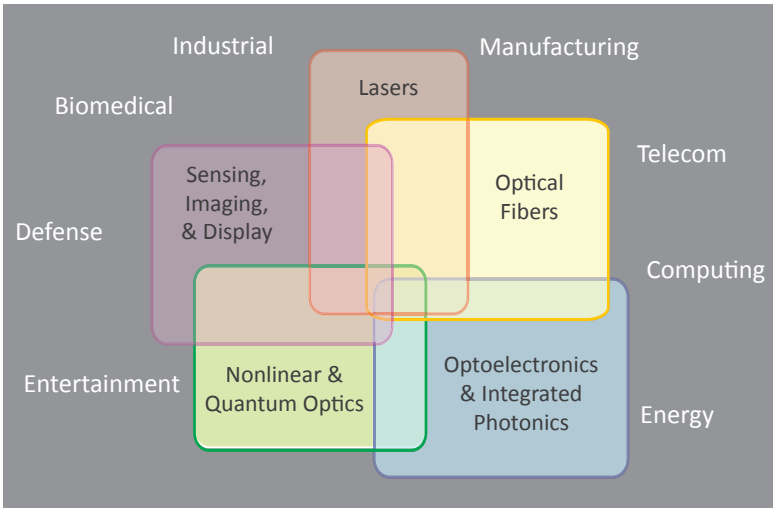
The Townes Laser Institute was established in 2007 in the presence of and in honor of Charles Townes, inventor of the concept of the laser, and a 1964 Nobel Laureate for Physics. Established for the development of next-generation lasers and their uses in medicine, advanced manufacturing and defense applications, 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, advanced 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 Prof. Peter Delfyett.

The 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, was 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 and to create and disseminate new knowledge in attosecond physics by conducting, presenting, and publishing cutting-edge fundamental and applied research, developing 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.

3.2 Areas of Research

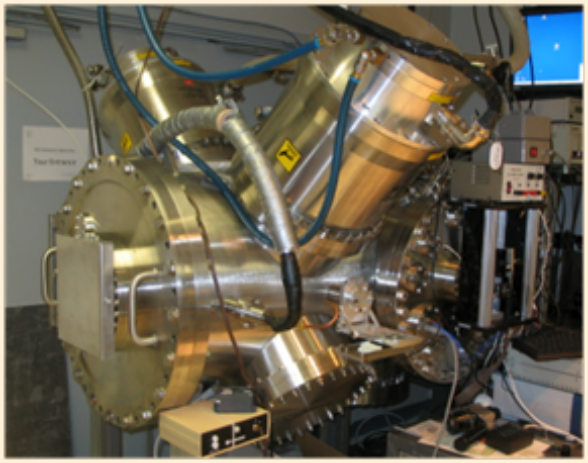
Five major photonics technologies are pursued in the college: lasers, optical fibers, optoelectronics and integrated photonics, nonlinear and quantum optics, and imaging, sensing and display. Research in each of these technologies covers materials, devices, and systems, and has broad applications in 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, and advanced topics such as nanophotonics, biophotonics, attosecond optics, and exotic optical materials and metamaterials, are being embraced as areas of strength and future growth. The college is well positioned to be a part of the revolution taking place in the 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/ResearchArea.aspx*



Lasers

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

Applications
- □ Laser-Based Manufacturing
- □ Laser-Based Microfabrication
- □ Laser Material Processing
- □ Medical Applications
- □ Laser Spectroscopy



Laser and Plasma Laboratory

Optical Fibers

Science & Technology
- □ Fiber Fabrication Technology
- □ Nano-Structured Fibers
- □ Polymer & Multimaterial NIR Fibers
- □ Mid Infrared Fibers
- □ Fiber Lasers

Applications
- □ Fiber Optic Communication
- □ Fiber Optic Networks
- □ Fiber Optic Sensing

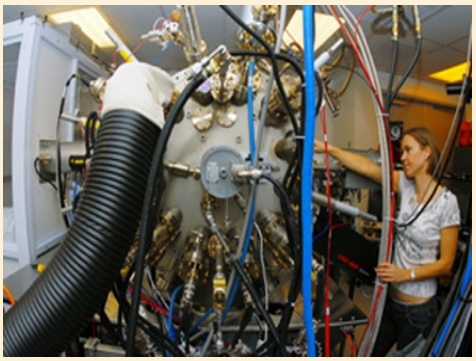
Fiber Drawing Towers

Optoelectronics & Integrated Photonics

Science & Technology
- □ III-V Semiconductor Devices
- □ Quantum Dot Technology, QCL
- □ Oxide Semiconductor Devices
- □ Organic Semiconductor Devices
- □ Photovoltaics
- □ Silicon Photonics
- □ Flexible Glass Integrated Photonics
- □ Nanoparticle & Nanowire Synthesis
- □ 3D Nanofabrication
- □ Plasmonics
- □ Periodic Structures & Photonic Crystals
- □ Gratings & Holographic Optical Elements

Applications
- □ Optical Communication
- □ Optical Processing & Switching
- □ Solar Energy Applications
- □ Integrated-Optic Sensing
- □ Integrated-Optic Signal Processing
- □ Medical Applications of Nanophotonics

MBE Facility



Nanophotonics Fabrication Facility

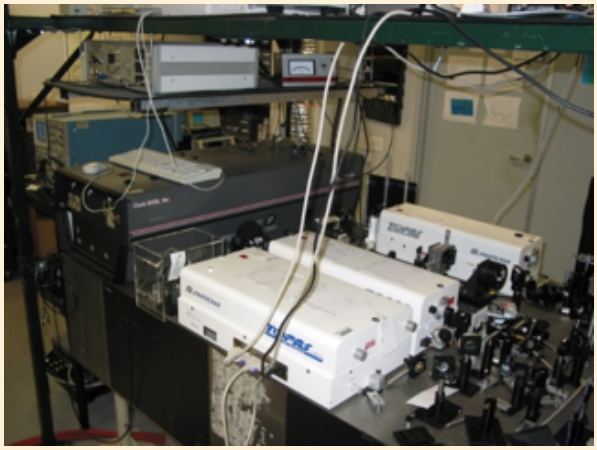
Nonlinear and Quantum Optics

Science & Technology

- □ Nonlinear Optical Materials
- □ Parametric & Multiphoton Processes
- □ High Harmonic Generation
- □ Nonlinear Waves in Waveguides & Lattices
- □ Optical Solitons
- □ Filamentation
- □ Photosensitive Glasses
- □ Entangled-Photon Quantum Information

Applications

- □ Switching and signal processing
- □ Metrology
- □ Spectroscopy and Meterial Identification
- □ Laser Protectors
- □ Quantum Communication & Sensing



Femto-second Nonlinear Optics Laboratory

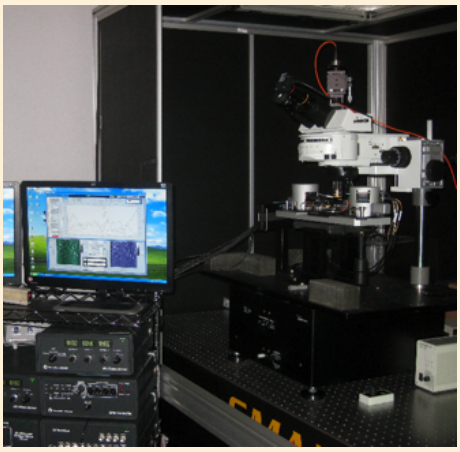
Sensing, Imaging, and Display

Science & Technology

- □ Nanophotonic & Plasmonic Sensors
- □ Near Field Imaging
- □ Fluorescence Nanoscopy
- □ X-ray & EUV Imaging
- □ Single-Molecule Imaging
- □ Computational Imaging
- □ Propagation in Random Media
- □ Infrared Sensors & Systems
- □ IR & THz Spectroscopy
- □ Liquid Crystal Technology

Applications

- □ Sensing
- □ Metrology
- □ Imaging
- □ Display



Near field microscope

3.3 Laboratories & 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.

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 scriber and 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 consisting of class 100 and class 10,000 cleanrooms. Used in the development of optoelectronic semiconductor devices. The facility equipment includes a Suss MJB-3 aligner, a Plasma-Therm 790 RIE/PECVD, an Edwards thermal evaporator, along with a bonder, a scriber 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

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.

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.

3.4 Research Highlights

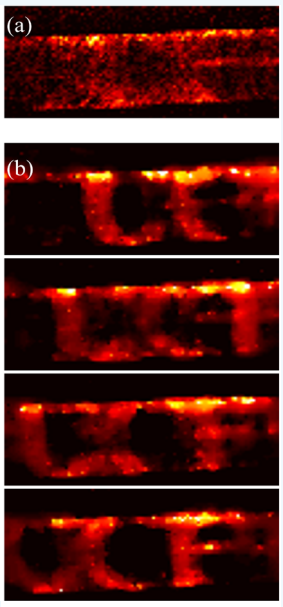
Microscopic Imaging: faster, bigger, just became cheaper

Since its invention in the late 16th Century, the optical microscope, has become an essential tool in modern biology, leading to numerous discoveries. Fluorescence is probably the most important optical readout mode because of its high sensitivity and specificity, compared with absorbance and reflectance. Whereas the remarkable breakthroughs based on fluorescence contrast, including the recent Nobel Prizes in green fluorescence protein and super-resolution microscopy, are only a couple of decades old, the fundamental optical design and data collection in the optical microscope have undergone very little change in the last 400 years. In the age of post genomics, the fundamental way we approach biological questions has been changed: more questions can and are necessary to be answered by massive data sets. In the quest of acquiring images with bigger field-of-view at a faster recording rate, microscope lenses with more complex design and sensors with higher readout speed have been developed. These approaches, reaching the performance bottleneck, make the system cost orders of magnitude higher than the common setups.

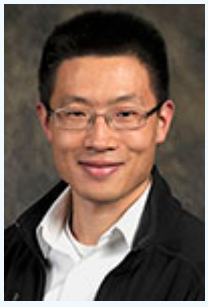
The two recent research projects in Sean Pang's Optical Imaging System Lab have demonstrated alternative approaches by combining the signal reconstruction techniques with unique systems design to improve the performance in microscopic imaging at a fraction of the cost.

In the first project, Pang's group have demonstrated a microscopy configuration achieving 200 frames per second with a consumer grade imager whose frame rates is 40 Hz, shown in the figure. The "UCF" logo was translated at speed of 2 mm/sec. Each letter of the logo has a dimension roughly 50 microns. If low-frame rate camera were used to capture the scene, we would record a blurred image with the fine features lost due to the motion. To restore the high-frame rate from low-frame rate measurement, structured illumination was employed as a coding mechanism in the prototype. Similar to super-resolution microscopy, where structured illumination has been employed to introduce a spatial frequency shift, the temporally coded multiplexing illumination channels the high temporal frequency components into low frame rate detection.

The cost of such a system is essentially the same as a conventional epi-fluorescence microscope, and the setup requires minimal modification. Many fundamental biological processes, especially neural activities, which have a time scale of several millisecond, and could previously be imaged only by use of an EMCCD camera, can now be recorded by use of a conventional sensor. In addition, the imaging methodology can work with any cameras, including EMCCD or sCMOS. With the top-of-the-line sensor, the frame rate could reach 100 mega frame per second, boosting the throughput in microfluidic analysis and opening new imaging possibilities.



Structured illumination temporally compressed microscope (SITCM). (a) Compressed image acquired at a low frame rate of 40 fps. (b) Reconstructed high frame rate images (160 fps) of the UCF logo.

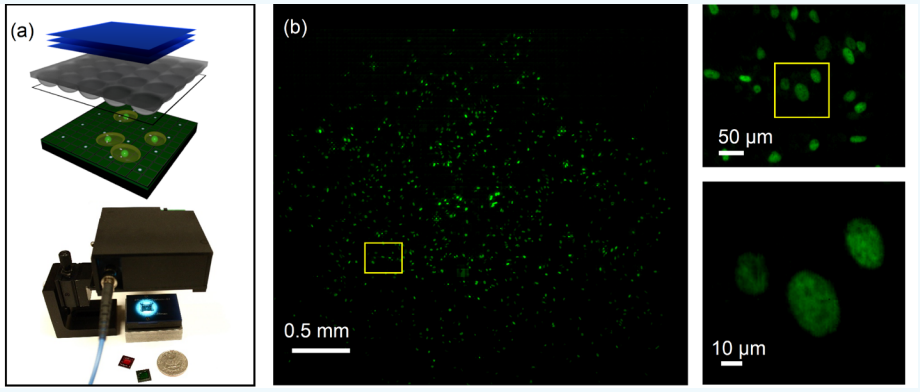


Sean Pang

Pang joined CREOL in 2015. He leads the Optical Imaging System Lab (OISL). Pang obtained his PhD degree in Electrical Engineering from California Institute of Technology in 2013, and conducted his postdoctoral research at Duke University.

Another effort in redesigning the microscope aims to increase its field-of-view (FOV). Due to limits imposed by optical aberrations, common microscope objectives (20×) have an FOV less than 1 mm. To scale up the FOV, additional lens elements are necessary, leading to a lower transmission objective with higher design and material cost. Pang's group came up with a compact microscopic imaging system utilizing the Talbot effect to project a grid of excitation light spots focused onto the sample which is placed on a CMOS sensor chip (see Figure 2). The fluorescence emission associated with each focal spot is collected by the sensor chip and are used to form a sparsely sampled fluorescence image. By scanning the Talbot focal spot grid across the sample and collecting a sequence of local images, a high-resolution fluorescence image can be reconstructed. In contrast to a conventional microscope, the collection efficiency, resolution, and FOV of the system are not tied to each other for this technique. As a result, the FOV of the system is directly scalable. A resolution of 1.2 μm was demonstrated in a prototype, and the collection efficiency is equivalent to that of a conventional microscope objective with a 0.70 N.A. The FOV is 100 times greater than a 20×/0.40 NA conventional microscope objective.

As the cellphone industry drove the cost of a CMOS sensor down to ~$2 apiece, a lensless microscope will bring the system's cost to less than $100. Due to its large FOV, high collection efficiency, compactness, and its potential for integration with other on-chip devices, FTM is suitable for diverse applications, such as point-of-care diagnostics, large-scale screening, and long-term automated imaging.



(a) Schematic diagram (top) and system setup of the Talbot microscope (bottom). (b) Fluorescence images of HeLa cells with GFP expression in nuclei by FTM: the magnified FTM image with the same FOV as 20× objective (top right), and a further magnified FTM image (bottom right).

Optical Multi-Filament Engineering

Nonlinear phenomena are fundamental to laser optics and photonics throughout a wide range of fields. However, these are generally neglected or intentionally avoided when considering free-space propagation of laser beams over >10 m. Ordinarily, air is considered a linear propagation medium although this is not true for sufficiently high laser intensities. Focusing laser beams to extremely high laser intensities is common in many fields such as inertial confinement fusion, coherent and incoherent X-ray/EUV generation, and to a lessor degree laser materials processing; however, in such cases the free-space propagation to the target is assumed or engineered to be linear often by operating at low pressure to reduce absorption, dispersion and/or nonlinear effects in air.

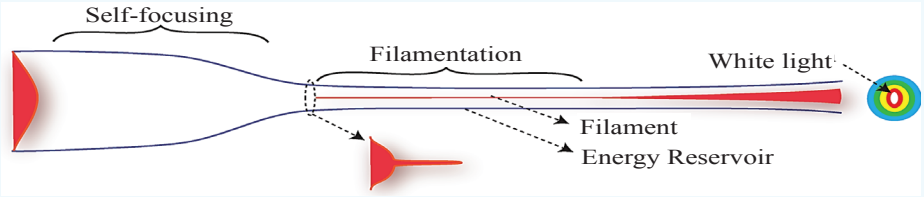
Array of plasmas induced from a single femtosecond laser beam

In 2014, CREOL faculty Matthieu Baudelet and Martin Richardson published a paper in Scientific Reports quantifying the transition from linear- to nonlinear-focusing regimes relative to laser peak power and the numerical aperture of the focusing geometry.

Most simplistically, ultrashort pulse laser filamentation describes the situation in which nonlinear self-focusing is sufficient to overpower linear diffraction and induces a collapse of the beam profile. At some point during the collapse, additional nonlinear processes counteract the initial self-focusing to form a region over which the beam propagates with a spike in the beam profile at a fixed intensity and fixed diameter. The process of filamentation is associated with ionization of the air and supercontinuum generation, which provide insight into the process of filamentation and are useful in a variety of applications, but which also take energy from the filament such that the beam expands after some propagation distance. This process depends upon the linear/nonlinear optical properties of the propagation medium and the beam distribution with respect to polarization, space, spectrum, and time. Whereas the illustration depicts the formation of a single filament with a peak intensity of ~$7x10^{13}$ W/cm^2 from a laser with 3-10 GW peak power and ~50 fs pulse duration at 800 nm center wavelength, the complexity of the situation increases as the initial peak power is scaled up. Effectively the processes that balance Kerr lensing and clamp the maximum intensity of the filament cause the beam to form multiple filaments. Given the interplay between the properties of the laser and the propagation medium, the formation of multiple filaments is extremely sensitive and flexible experiments are critical for generating the data necessary to improve existing theory and modeling. It is highly desirable to be able to engineer array structures based upon filaments in air, as shown in the photo. While the short scale plasma array shown here corresponds to high numerical aperture focusing and therefore is not filamentation, it provides an illustration of the potential hyperbolic metamaterials that could be generated in air, as was noted in a Nature Communications article in 2013 with colleagues from University of Buffalo.

From controlled super-continuum generation to novel RF waveguides

The ability to project laser beams with high intensity controllably over long range is highly desirable for emerging applications, most notably remote sensing. As part of various research efforts at CREOL have shown, the control of long-range propagation of high intensity laser pulses fundamentally requires understanding of both linear and nonlinear phenomena. Although not unique to ultrashort laser pulses, the interplay of nonlinear and linear propagation is fundamental to ultrashort pulse laser filamentation in air. CREOL is central to filamentation research in the US, from studying the fundamental physics to developing "real world" applications. With funding from multiple agencies (most notably ARO, AFOSR, and JTO) as part of collaborative research with groups within UCF as well as several other universities, the Laser and Plasma Laboratory is in the process of major facility improvements to support several initiatives in long-range filament projection and engineering.



A laser development team lead by Lawrence Shah has recently completed "shake-down" experiments of the multi-terawatt laser facility (MTFL) and filamentation test ranges. The laser itself is a homemade Ti:sapphire system producing 230 mJ pulses with < 50 fs pulse duration at 10 Hz. During the design and construction of this system, several features have been incorporated to optimize long-term stability and thereby minimize noise in filamentation data. In particular, numerous methods are in place to maximize beam quality by mitigating intensity modulation, aberration and spatial chirp as these have significant impact on filamentation. For propagation experiments, we use two ranges. A 10-m in-lab range provides us with the ability to characterize the beam and the resultant "secondary effects" in detail under controlled conditions along the propagation length. Since certain filamentation conditions cannot be achieved within a 10-m range, a supplementary 50-m range has been developed utilizing a building service chase. Although the propagation environment is not as controlled as the in-lab range, this facility is critical to demonstrate the design of multiple filaments and the creation of specific profile structures along the propagation axis.

With the addition of DURIP funding, the team is completing the construction of Chamber for Laser Propagation Through Aerosol Medium (CLaPTAM) to broaden their studies to include the interactions of laser filaments with clouds and they are in the midst of construction of a novel Mobile Ultrafast High Energy Laser Facility (MUHELF) that will enable km-range propagation of ultrashort pulse filaments at the Townes Innovative Science and Technology Experimental Facility (TISTEF).

Matthieu Baudelet

Martin Richardson

Lawrence Shah

Ultra-Broadband Frequency Combs Span the Mid-Infrared

Mid-infrared subharmonic optical parametric oscillators (OPO) produce frequency comb light with one-and-half-octave-wide instantaneous band and superior temporal coherence, suitable for real-time trace molecular detection.

Optical parametric oscillators (OPOs) have long been recognized as a versatile means of producing optical output in important spectral regions unreachable by laser sources. The mid-IR (> 2.5 µm) is one such region, rich in spectroscopic information but underpopulated by convenient laser lines. In a typical OPO, a laser pumps a suitable optical material having second-order nonlinear susceptibility. When combined with an appropriate resonator for optical feedback, the OPO splits a photon into two photons (signal and idler) with longer wavelengths. The oscillation wavelength is tuned by adjusting the parameters of the resonator or nonlinear material. With their broad tunability OPOs are used extensively for mid-IR spectroscopy. Quantum-cascade lasers (QCLs) now offer a tantalizing alternative to OPOs, although with somewhat smaller tuning range. It is challenging however, for both OPOs and QCLs, to be tuned in a precise and continuous fashion, preserving narrow-linewidth single-longitudinal-mode operation for precision spectroscopic measurements.

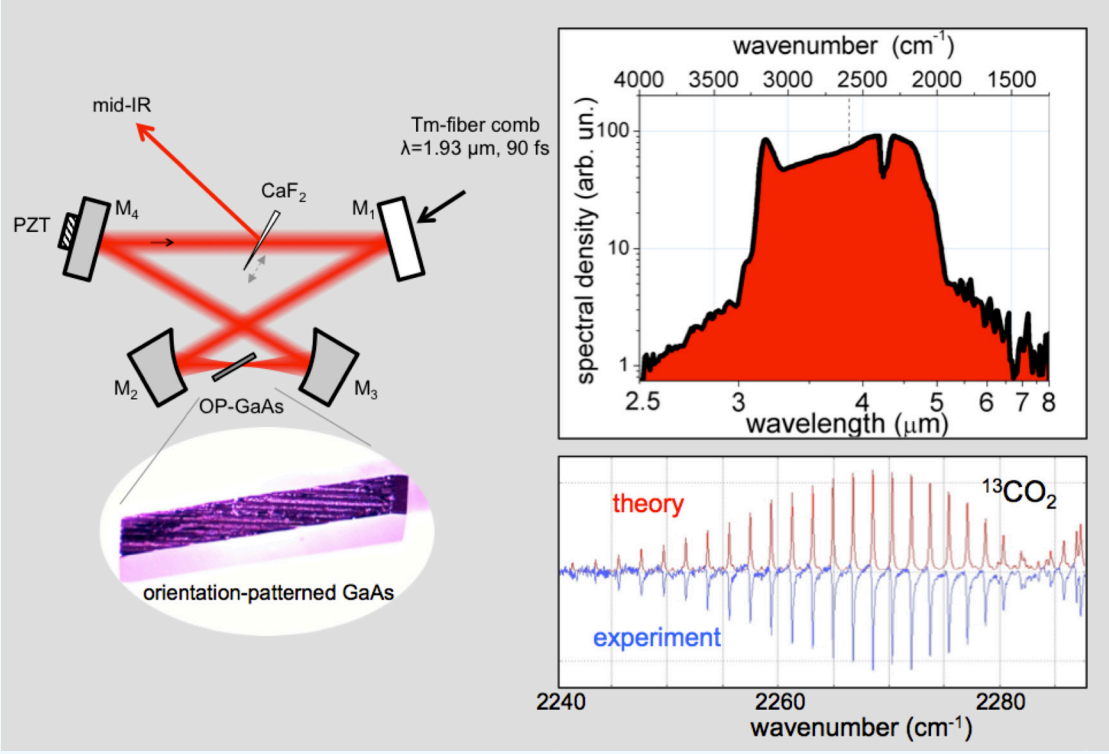
Konstantin Vodopyanov

Fourier Transform (FT) spectroscopy is a nice mathematical trick that helps evade this limitation. As originally proposed by Michelson more than a century years ago, one can perform high-resolution spectroscopy even with a broadband source. To retrieve the whole optical spectrum one just needs to interfere an optical beam with its time-delayed replica and then take a Fourier transform of the detector signal versus time delay dependence. The gold rush for creating broadband mid-IR frequency combs – laser sources with the output consisting of manifold of equally spaced phase locked spectral lines – began a decade ago. A number of techniques were used that include mode-locked lasers, optical rectification, difference-frequency generation, OPOs, whispering gallery microresonators, and QCLs. Doubly resonant OPOs operating at degeneracy, pioneered by the group of Konstantin Vodopyanov, are a special class of synchronously pumped OPOs that combine low pump threshold with an exceptionally broad oscillation bandwidth. These devices can produce a broadband frequency comb centered at twice the pump wavelength. Most importantly, they inherit the coherence properties of the pump laser. Vodopyanov and his team have demonstrated broadband mid-IR combs in a number of degenerate (subharmonic) OPO systems using both periodically poled lithium niobate (PPLN) and orientation-patterned gallium arsenide (OP-GaAs) crystals as the nonlinear optical material. These were combined with a variety of pump sources including erbium-fiber (1.56 µm) thulium-fiber (2 µm), Cr:ZnSe (2.45 µm) and Cr:ZnS (2.35 µm) mode-locked lasers. With the thulium-fiber pump, a world-record mid-IR frequency comb spectral span of 2.6 to 7.5 µm was achieved in 2015. Such frequency comb is especially suitable for massively parallel, simultaneously broadband and high-resolution spectroscopy, based on the Fourier transform principle.

World-record mid-IR frequency comb with 2.6–7.5 µm spectral span

The most attractive approach is dual-comb (or multi-heterodyne) spectroscopy, when two phase-locked frequency combs having a small offset in the comb spacing are combined and used for interrogating molecular spectral signatures. Operating in the middle of the spectroscopically important "fingerprint" region, where OH, CH, CO, and NH bonds show their strongest vibrational signatures has allowed sensitive (down to part-per-billion concentration) real-time (~1 sec) and massively parallel (about a million spectral points) trace gases measurements through their effect on the OPO spectrum.

Also, there is an on-going research in Vodopyanov's lab (DARPA SCOUT program) – on creating a chip-scale broadband mid-IR comb for the real-time and real-world molecular sensing.



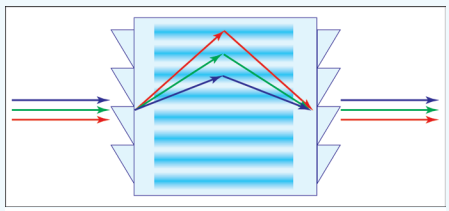
Left: Broadband subharmonic GaAs OPO system pumped by a mode-locked Tm-fiber laser produces a frequency comb spanning 2.6–7.5 µm.

Right Frequency comb spectrum. Also shown is transmission spectrum of the isotopic CO2 measured in the atmosphere. Theoretical plot is inverted for clarity.

Achromatic Phase Elements

Achromatization by Combined Volume Bragg Gratings & Surface Diffraction Gratings

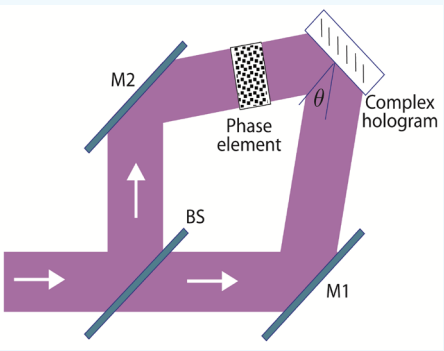
Over the last decades phase masks have found numerous applications including imaging, encryption, beam shaping, and mode conversion. There are two typical methods of making such masks. The first one controls the local geometrical path length by generating a contoured surface while the second method changes the local refractive index in the bulk of a photosensitive medium such as lithium niobate or photosensitive glass. Both methods can be employed to generate phase masks with almost any profile. However, because the phase shift is induced by changing the local optical path length these phase masks are inherently limited to use at a specific wavelength, which limits the range of potential applications. To extend this range achromatic phase masks have been previously produced utilizing complex fabrication approaches.



Concept of using surface gratings pairs to meet the Bragg condition for various wavelengths regardless of angle tuning.

Leonid Glebov and his group recently developed a new holographic element that can be utilized as achromatic phase plate. It is generated by encoding stepped or grey level phase mask profiles into transmitting volume Bragg grating (TBG) and is named "holographic phase mask" (HPM). It was shown that HPMs can produce identical to a standard phase plate diffracted phase profiles over a wide range of wavelengths as long as the Bragg condition of the volume grating is satisfied.

The HPM also utilizes the diffraction characteristics of a TBG, which can diffract up to 100% of a beam into a single order, and can diffract over a broad range of wavelengths by changing the angle of incidence (with the diffraction efficiency depending on the wavelength and strength of the grating). The high angular selectivity of a TBG also allows for several TBGs to be multiplexed into the same element with little to no cross-talk between gratings; each grating is accessed by altering the beam's angle of incidence onto the element.

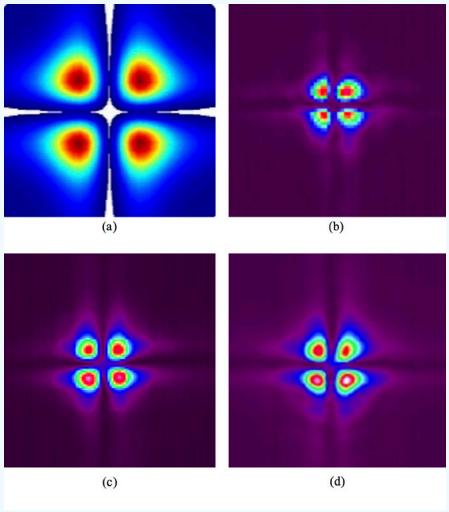


It is important to note that a Bragg grating is the simplest volume hologram, which, unlike more complex holograms, can diffract narrow wavelength band incoming at a given angle, without distorting the beam profile. By encoding phase levels which cover a macroscopic area, the HPM acts locally as a standard TBG with a given phase shift. Thus the HPM will diffract in the same manner as a standard TBG except at the relatively small number of phase discontinuities, and the diffracted beam's phase profile will match the encoded phase level profile regardless of incident wavelength. The HPM therefore acts as a spectrally addressable phase mask.To simplify fabrication and to provide a clear demonstration of the phenomenon binary phase profiles were used to create HPM, but the approach is fully applicable for multi-level phase masks as well. To show the unique properties, a four-sector binary phase mask was chosen as an example. The expected far field intensity profile for a beam passing through the center of a four-sector regular binary phase mask consists of a four-lobed clover pattern. As shown in the figure, for three very different Bragg wavelengths (632.8 nm, 975 nm, and 1064 nm), the diffracted beam profiles exhibited the predicted four-lobed pattern. This clearly confirms that the binary phase profile is being preserved in the diffracted order for an extremely broad range of wavelengths.

True achromatization of HPMs can be achieved with the concept of pairing the Bragg grating with two surface gratings According to the well-known grating dispersion equation a surface grating with a given period (Λ_{SG}) will diffract normally incident light an angle (θ) in different orders as a function of wavelength (λ). Simultaneously, from coupled wave theory, a VBG will diffract light highly efficient at the Bragg condition. In order for the diffraction angles to match and therefore the surface and volume gratings to work together the condition comes to:

$$2\Lambda_{VBG} = \Lambda_{SG}$$

Therefore, if the surface grating period is double the period of the volume Bragg grating, then any first order diffraction by normally incident light will be at the corresponding Bragg condition of the volume Bragg grating and that will hold for any wavelength. If an identical surface grating is added in a mirror orientation to the transmitting volume Bragg grating like shown in the figure, the dispersion will be completely canceled and the outgoing beam will be re-collimated. Applying this concept to the holographic phase mask alleviated the need for angle tuning so the Bragg condition can be met, making it a fully achromatic phase element.



(a) Simulated far field profile of a beam after passing through an ideal four-sector binary mask and the diffracted beam from a four-sector HPM at (b) 632.8 nm, (c) 975 nm, and (d) 1064 nm.

The experiments conducted with such system demonstrated highly efficient mode conversion from a Gaussian to a TEM_{11} mode for a range of more than 300 nm without the need for any angular adjustments.

Prof. Glebov's group continues to implement VBGs in many high- and low-power laser and photonics applications.

Leon Glebov

Ivan Divliansky

Hybrid optical nanocomposites: a low-cost solution to radiation sensors

Nanocomposites, in particular inorganic-organic hybrids, allow for a wide range of combinations of phases with broad applications including solar energy harvesting, lighting, imaging, radiation sensing, lasers, magneto-optics and plasmonics. Intense research efforts on optical nanocomposites are being motivated by the fascinating prospect that these materials can assume the optical properties of the inorganic phase and yet be processed with the shape versatility, low-cost and ease of polymeric materials.

In the area of radiation sensing for example, the United States Departments of Homeland Security (DHS) and Customs and Border Protection (CBP) have been tasked to screen every cargo container crossing domestic borders for illicit radioactive material. This is accomplished by using gamma-ray spectrometers capable of discriminating regulated special nuclear materials from non-threatening radioisotopes. To this end, scintillation detector systems, specifically thallium-doped sodium iodide (Tl:NaI) single crystals, are by far the most popular due to their reasonable performance and cost. In recent years, however, the demand for scintillator materials with improved light-yield, timing and energy resolution resulted in a wealth of new materials with attractive properties. Remarkable single-crystals, such as Ce:$LaBr_3$ and Eu:SrI_2, with light outputs and energy resolution surpassing those of Tl:NaI, have been discovered but, the difficulty of their growth and size-scalability are currently limiting their commercialization.

Transparent ceramic scintillators, in which CREOL's Optical Ceramics Laboratory led by Dr. Romain Gaume is actively engaged in, offer valuable alternatives to this scalability issue. Yet, in a serendipitous research twist, Gaume's group developed an innovative method to fabricate monolithic transparent hybrid nanocomposites with very high particle loading and high refractive index mismatch tolerance between the inorganic and organic constituents. By providing adequate radiation stopping power, such high-loading fraction composites would yet provide another means to scale-up the size of scintillation detectors.

Hybrid scintillator composites consist of nano- to micro-scale luminescent phosphors dispersed in liquid monomers that are cured into near net-shape bulk size scintillators. This fabrication strategy uses inexpensive organic matrices and does not require the growth of large crystals. The dispersion of particles in an organic host however is of paramount importance to obtain composites of high optical quality. Nano-scale powders tend to agglomerate into clusters, and the refractive index mismatch between the powders and the organic phase leads to light scattering even when the refractive indices of the inorganic and organic phases are closely matched. The new concept proposed by the CREOL team takes advantage of two complementary techniques: (i) the production of high-quality ceramic powder-compacts (so called "green-bodies") used and being developed for the fabrication of transparent ceramics and (ii) a polymer impregnation technique. Ceramic green-bodies, made by consolidation of unagglomerated particles, form an open network of interconnected porosity suitable for liquid monomer impregnation.

Gaume's group developed an innovative method to fabricate monolithic transparent inorganic-organic nanocomposites

The characteristic of the so-called ceramic open-porosity determines the inorganic loading of the composite once infiltrated by the monomer and the size of the polymer inclusions which form after in-situ polymerization. Thus, the inorganic volume fraction of the nanocomposites can be varied through the use of different green-body forming techniques.

This new approach was demonstrated on acrylate-based nanocomposites containing over 60 vol% (i.e. 84 wt%) CaF_2 nanoparticles. Because of its versatility, the technique could be advantageously used om other applications including optical sensing, low-power lasers, Christiansen filters, information storage and even beyond the realm of optical materials.

This summary was adapted from S. Chen and R. Gaume's recent paper published in Applied Physics Letters, December 2015.

Romain Gaume

The Optical Ceramics group conducts research on transparent polycrystalline materials for high-power lasers, nuclear and radiological scintillator detectors, and applications in nonlinear optics..

The UCF logo displayed through a transparent CaF2-acrylate nanocomposites containing over 84 wt% CaF_2.

3.5 Publications and Presentations

Names of 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; names of CREOL scientists and also students with no faculty co-authors are highlighted in green.

Book Chapters

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Conference Papers and Presentations

A. Rylyakov, J. Proesel, S. Rylov, B. Lee, J. Bulzacchelli, **A. Ardey**, C. Schow, M. Meghelli, "*A 25 Gb/s burst-mode receiver for low latency photonic switch networks*," Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

A. Rylyakov, J. Proesel, S. Rylov, B. Lee, J. Bulzacchelli, **A. Ardey**, B. Parker, M. Beakes, C. Baks, C. Schow, M. Meghelli, "*A 25 Gb/s burst-mode receiver for rapidly reconfigurable optical networks*," International Solid-State Circuits Conference, San Francisco, CA, February (2015).

B. Anderson, A. Flores, R. Holten, T. Ehrenreich, I. Dajani, "*Beam combining and SBS suppression in white noise and pseudorandom modulated amplifiers*," SPIE 9344, Fiber Lasers XII: Technology, Systems, and Applications, 93441U, SPIE Photonics West, San Francisco, CA, February (2015).

J. van Weerdenburg, A. Velazquez-Benitez, R. van Uden, P. Sillard, D. Molin, A. Amezcua-Correa, J. Antonio-Lopez, M. Kuschnerov, F. Huijskens, H. de Waardt, A. Koonen, **R. Amezcua Correa**, C. Okonkwo, "*10 spatial mode transmission over low differential mode group delay fibre employing all-fibre photonic lanterns*," European Conference on Optical Communication, Valencia, Spain, September (2015).

R. Ryf, H. Chen, N.K. Fontaine, A.M. Velazquez-Benítez, J. Antonio-López, C. Jin, B. Huang, M. Bigot-Astruc, D. Molin, F. Achten, P. Sillard, **R. Amezcua Correa**, "*10-mode mode-multiplexed transmission over 125-km single-span multimode fiber*," PDP.3.3, European Conference on Optical Communication, Valencia, Spain, September (2015).

N.K. Fontaine, R. Ryf, H. Chen, A. Velazquez Benitez, J.E. Antonio Lopez, **R. Amezcua Correa**, B. Guan, B. Ercan, R.P. Scott, S.J. Ben Yoo, L. Gruner-Nielsen, Y. Sun, R.J. Lingle, "*30×30 MIMO transmission over 15 spatial modes*," Post Deadline Papers Session III, Th5C, Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

H. Wen, H. Zheng, Q. Mo, A.M. Velazquez-Benitez, C. Xia, B. Huang, H. Liu, H, Yu; J.E.A. Lopez, **R. Amezcua Correa**, **G.F. Li**, "*Analog fiber-optic links using high-order fiber modes,*" European Conference on Optical Communication, Valencia, Spain, September (2015).

Z. Sanjabi Eznaveh, G. López-Galmiche, E. Antonio-López, **R. Amezcua Correa**, "*Bi-directional pump configuration for increasing thermal modal instabilities threshold in high power fiber amplifiers,*" SPIE 9344, Fiber Lasers XII: Technology, Systems, and Applications, 93442G, SPIE Photonics West, San Francisco, CA, February (2015).

C. Xia, H. Wen, A.M. Velazquez-Benitez, N. Chand, J.E. Antonio-Lopez, B. Huang, H. Liu, H.J. Zheng, P. Sillard, X. Liu, F. Effenberger, **R. Amezcua Correa**, and **G.F. Li**, "*Experimental demonstration of 5-mode PON achieving a net gain of 4 dB in upstream transmission loss budget*," European Conference on Optical Communication, Valencia, Spain, September (2015).

A.M. Velázquez-Benítez, J. Antonio-López, J. Alvarado-Zacarías, G. Lopez- Galmiche, P. Sillard, D. van Ras, C. Okonkwo, H. Chen, R. Ryf, N. Fontaine, and **R. Amezcua Correa**, "*Scaling the fabrication of higher order photonic lanterns using microstructured preforms*," European Conference on Optical Communication, Valencia, Spain, September (2015).

H.E. Kondakci, A.P. Leija, A. Szameit, **A. Abouraddy, D.N. Christodoulides, B.E.A. Saleh**, "*Deterministic Control of Photon Statistics by Activation of Chiral Symmetry in Disordered Lattices*," FTh2G.2, OSA-FIO/LS, San Jose, CA, October (2015).

Z. Chang, "*Attosecond transient absorption spectroscopy,*" 27th International Conference on Photochemistry, Jeju Island, Korea, June (2015). ***Invited***

X. Yu, **Z. Chang**, P.B. Corkum, and S. Lei, "*Damage formation on fused silica illuminated with ultraviolet-infrared femtosecond pulse pairs*," SPIE Optics and Optoelectronics, Prague, Czech Republic, April (2015). ***Invited***

Z. Chang, "*High power isolated attosecond pulse generation with a 200 TW laser*," 5th International conference on Attosecond Physics, Saint-Sauveur, Québec, Canada, July (2015). ***Invited***

Y. Cheng, M. Chini, X.M. Tong, A. Chew, J. Biedermann, Y. Wu, E. Cunningham, and **Z. Chang**, "*Quantum beats in attosecond transient absorption of krypton autoionization states*," FTh3C.3, CLEO: QELS Fundamental Science, San Jose, CA, May (2015).

A. Perez-Leija, M. Gräfe, M. Lebugle, R. Heilmann, S. Nolte, H. Moya-Cessa, **D.N. Christodoulides**, and A. Szameit, "*Biphoton evolution equation for discrete optical systems*," EA-P-9, European Conference on Lasers and Electro-Optics, Munich, Germany, June (2015).

A. U. Hassan, N. Nye, M. Khajavikhan, R. El-Ganainy. **D. N. Christodoulides**, "*Ultra-sensitivity using higher order exceptional points*," Session 31, The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, April (2015).

H. Hodaei, W. Hayenga, M.A. Miri, A. Ulhassan, **D.N. Christodoulides**, and **M. Khajavikhan**, "*Dark state microring lasers: Using non-Hermitian exceptional points for mode management,*" JTh5B.6, CLEO, San Jose, CA, June (2015).

K. Makris, Z. Musslimani, **D.N. Christodoulides**, and S. Rotter, "*Diffractionless Waves of Constant Intensity*," LM2I.3, OSA-FIO/LS, San Jose, CA, October (2015).

M. Clerici, Y. Hu, P. Lassonde, C. Milián, A. Couairon, **D.N. Christodoulides**, Z. Chen, L. Razzari, F. Vidal, F. Légaré, D. Faccio, and R. Morandotti, "*Guiding Discharges along Curved Paths*," LM3I.3, OSA-FIO/LS, San Jose, CA, October (2015).

M. Clerici, Y. Hu, P. Lassonde, C. Milián, A. Couairon, **D.N. Christodoulides**, Z. Chen, L. Razzari, F. Vidal, F. Légaré, D. Faccio, and R. Morandotti, "*Guiding Discharges Around Obstacles*," CD-7-4, European Conference on Lasers and Electro-Optics, Munich, Germany, June (2015).

W. Song, R. Gatdula, S. Abbaslou, M. Lu, A. Stein, W.Y. Lai, J. Provine, F. Pease, **D.N. Christodoulides**, and W. Jiang, "*High-Density Low-Crosstalk Waveguide Superlattice*," FM1F.6, OSA-FIO/LS, San Jose, CA, October, (2015).

M. Gräfe, R. Heilmann, A. Perez-Leija, R. Keil, F. Dreisow, M. Heinrich , S. Nolte, and **D.N. Christodoulides**, A. Szameit, "*High-order W-states for random number generation*," EA-1-3, European Conference on Lasers and Electro-Optics, Munich, Germany, June (2015).

M. Clerici, Y. Hu, C. Milian, A. Couairon, **D.N. Christodoulides**, Z. Chen, L. Razzari, F. Vidal, F. Legare, D. Faccio, and R. Morandotti, "*Laser guided curved electric discharges*," FM1D.1, CLEO, San Jose, CA, June (2015).

D.N. Christodoulides, "*Nonlinear interactions in optical lattice systems*," FM2E.4, CLEO, San Jose, CA, June (2015).

M. Wimmer, A. Regensburger, M.A. Miri, C. Bersch, **D.N. Christodoulides**, and U. Peschel, "*Observation of PT-symmetric optical solitons in time-domain photonic lattices*," FM2D.4, OSA-FIO/LS, San Jose, CA, October (2015).

D.N. Christodoulides, and M. A. Miri, "*PT symmetry in Optics*," Session 12, The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, April (2015).

M. A. Miri, N. Nye, **D.N. Christodoulides**, and H. Hodaei, "*PT-symmetric diffraction gratings*," Session 31, The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, April (2015).

H. Hodaei, M.A. Miri, M. Heinrich, **D.N. Christodoulides,** and **M. Khajavikhan**, "*PT-symmetric microring lasers*," SPIE Photonics West San Francisco, CA, (2015).

H. Hodaei, M. A. Miri, M. Heinrich, **D.N. Christodoulides,** and **M. Khajavikhan**, "*PT-symmetric microring lasers*," SPIE Photonics West, San Francisco, CA, February (2015).

M. Heinrich, H. Hodaei, M.A. Miri, **D.N. Christodoulides,** and **M. Khajavikhan**, "*PT-symmetric microring lasers*," CB-4-4, European Conference on Lasers and Electro-Optics, Munich, Germany, June (2015).

W. Hayenga; M.A. Miri; H. Hodaei, A. Ulhassan, M. Heinrich, **D.N. Christodoulides,** and **M. Khajavikhan**, "*Single mode broad area PT-symmetric microring lasers*," FW1D.6, CLEO, San Jose, CA, June (2015).

N. Nye, M. Miri, and **D.N. Christodoulides**, "*Single-Sided Diffraction by PT-Symmetric Metasurfaces*," FTu2C.5, CLEO, San Jose, CA, June (2015).

L. Wright, W. Renninger, **D.N. Christodoulides**, and F. Wise, "*Spatiotemporal dynamics of multimode optical solitons*," FW4D.1, CLEO, San Jose, CA, June (2015).

L. Wright, **D.N. Christodoulides**, and F. Wise, "*Spatiotemporal nonlinear optics in multimode fibers,*" SM2L.6, CLEO, San Jose, CA, June (2015).

M. Heinrich, M.A. Miri, S. Stutzer, S. Nolte, A. Szameit, and **D.N. Christodoulides**, "*Supersymmetric photonics: From mode converters to a new class of transformation optics*," pp. 103-105, 9th International Congress on Advanced Electromagnetic Materials in Microwaves and Optics, Oxford, United Kingdom September (2015).

D.N. Christodoulides, "*PT symmetry in Optics*," S6.00004, APS March Meeting, San Antonio TX, March (2015). ***Invited***

M. Wimmer, A. Regensburger, M.A. Miri, C. Bersch, **D.N. Christodoulides**, and U. Peschel, "*Photonic Mesh Lattices: From PT Solitons to Optical Superfluidity*," EF-2.3, The European Conference on Lasers and Electro-Optics, Munich, Germany, June (2015). ***Invited***

M. Heinrich, M. A. Miri, S. Stützer, S. Nolte, A. Szameit, and **D.N. Christodoulides**, "*Supersymmetric photonics: Mode conversion, scattering and transformation optics*," NTu2A.6, OSA Nonlinear Optics Meeting, Kauai, HI, July (2015). ***Invited***

M.A. Miri, M. Heinrich, and **D.N. Christodoulides**, "*Supersymmetry and transformation optics,*" T9.00008, APS Meeting, San Antonio TX, March (2015).

M. Miri, M. Heinrich, and **D.N. Christodoulides**, "*Supersymmetry and transformation optics on the line*," FTh3D.8, CLEO, San Jose, CA, June (2015).

H. Hodaei, W.E. Hayenga, M.A. Miri, A. Ulhassan, **D.N. Christodoulides,** and **M. Khajavikhan** , "*Tunable parity-time-symmetric microring lasers*," SF1I.1, CLEO, San Jose, CA, June (2015).

A. Leija, M. Graefe, R. Heilmann, M. Lebugle, S. Nolte, H. Moya-Cessa, **D.N. Christodoulides**, and A. Szameit, "*Two-photon evolution equation for multiport optical systems*," JW2A.20, CLEO, San Jose, CA, June (2015).

A. Hassan: N. Nye and **D.N. Christodoulides**, "*Ultra sensitivity using higher order exceptional points*," Session 31, The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, April (2015).

K. Makris, Z. Musslimani, **D.N. Christodoulides**, and S. Rotter, "*Waves of constant intensity and their instabilities in non-Hermitian photonic structures*," JTu5A.18, CLEO, San Jose, CA, June (2015).

E. Sarailou, and **P.J. Delfyett**, "*A linearized intensity modulator for analog optical links using a three-section mode-locked laser*," pp. 140-141, IEEE Photonics Conference (IPC), Reston, VA, October (2015).

A. Klee, K. Bagnell, and **P.J. Delfyett**, "*Broadband, Low Noise Modelocked Semiconductor Laser with Intracavity Programmable Dispersion Control*," SM3P.7, CLEO, San Jose, CA, June (2015).

A. Klee, K. Bagnell, and **P.J. Delfyett**, "*Coupled opto-electronic oscillator with three-point stabilization*," LTh4D.2, OSA-FIO/LS, San Jose, CA, October (2015).

K. Bagnell, A. Klee, and **P.J. Delfyett**, "*Improvement in optical linewidth of a semiconductor-based mode locked laser by increasing cavity Q*," LTh4H.5, OSA-FIO/LS, San Jose, CA, October (2015).

S. Bhooplapur, A. Klee, and **P.J. Delfyett**, "*Injection-locked VCSEL arrays for line-by-line pulse-shaping with update times of less than 1 ns*," SM2P.8, CLEO, San Jose, CA, June (2015).

E. Sarailou, and **P.J. Delfyett**, "*Monolithic three-section injection-locked laser for optical oversampled analog-to-digital conversion*," FW5B, OSA-FIO/LS, San Jose, CA, October (2015).

A. Klee, K. Bagnell, and **P.J. Delfyett**, "*Towards a coupled opto-electronic oscillator with independently stabilized frequency and repetition rate*," WC1.1, IEEE Photonics Conference (IPC), Reston, VA, October (2015).

E. Sarailou, and **P.J. Delfyett**, "*Towards highly linear intensity modulator for high resolution photonic ADCsusing a three-section mode-locked laser,*" Proc. STh4F.6, CLEO, San Jose, CA, June (2015).

P.J. Delfyett, S. Bhooplapur, A. Klee, and E. Sarailou, *"Coherent optical signal processing using optical frequency combs and injection locked vcsels*," Asia Photonics Conference, Hong Kong (2015). ***Invited***

P.J. Delfyett, S. Bhooplapur, A. Klee, E. Sarailou, and K. Bagnell, "*Optical frequency combs from mode-locked diode lasers – applications in communications, signal processing and radar for avionics,*" IEEE Avionics and Vehicle Fiber-Optics and Photonics Conference, Long Beach, CA, October (2015). ***Invited***

P.J. Delfyett, S. Bhooplapur, A. Klee, and E. Sarailou, "*Ultrafast coherent optical signal processing using stabilized optical frequency combs from mode-locked semiconductor diode lasers,*" IEEE Photonics Conference (IPC), Reston, VA, October (2015). ***Invited***

P.J. Delfyett, "*Ultrafast laser technology and applications at CCNY,*" SPIE Third International Conference on Optical Angular Momentum, New York, NY, August (2015). ***Keynote Invited***

X. Yang, M. Li, G. Zhao, Y. Zhang, S. Freisem, **D.G. Deppe**, "*Small-sized lithographic single-mode VCSELs with high-power conversion efficiency,*" SPIE 93810, Vertical-Cavity Surface-Emitting Lasers XIX, 93810R (2015).

M.I. Akhlaghi-Bouzan, T. Kohlgraf-Owens, and **A. Dogariu**, "*Active illumination low-light computational correlation microscopy,*" LM2H.2, OSA-FIO/LS, San Jose, CA, October (2015).

M.I. Akhlaghi-Bouzan, and **A. Dogariu**, "*Computational optical density-density correlation sensing*," STh3O.7, CLEO, San Jose, CA, June (2015).

C. Constant, S. Sukhov, and **A. Dogariu**, "*Controllable diffusion in time-varying random potentials*," FTh2G.3, OSA-FIO/LS, San Jose, CA, October (2015).

R. Rezvani Naraghi, S. Sukhov, and **A. Dogariu**, "*Designing all-dielectric structures for efficient directional scattering*," FTh4F.6, OSA-FIO/LS, San Jose, CA, October (2015).

S. Sukhov, V. Kajorndejnukul, J. Broky, and **A. Dogariu**, "*Experimental detection of forces in an optical analog of aharonov-bohm effect,*" FM2D.8, CLEO: QELS, San Jose, CA, June (2015).

M.I. Akhlaghi-Bouzan, T. Kohlgraf-Owens, and **A. Dogariu**, "*Low-light reflective correlation imaging*," STu2K.1, CLEO, San Jose, CA, June (2015).

S. Sukhov, V. Kajorndejnukul, R. Rezvani Naraghi, and **A. Dogariu**, "*Mechanical action of optical spin-orbit interaction*," FTu5F.6, OSA-FIO/LS, San Jose, CA, October (2015).

R. Rezvani Naraghi, S. Sukhov, and **A. Dogariu**, "*Near field measurements of the scattering phase function with evanescent field excitation*," JTu5A.77, CLEO: QELS, San Jose, CA, June (2015).

R. Rezvani Naraghi, S. Sukhov, and **A. Dogariu**, "*Near-field corrections in mesoscopic transport*," LTh2H.3, OSA-FIO/LS, San Jose, CA, October (2015).

R. Rezvani Naraghi, S. Sukhov, and **A. Dogariu**, "*Near-field intensity fluctuations: the role of disorder correlations*," LTh1H.6, OSA-FIO/LS, San Jose, CA, October (2015).

S. Sukhov, A. Shalin, D. Haefner, and **A. Dogariu**, "*Nonreciprocal optical interaction of dissimilar particles*," FF2C.6, CLEO, San Jose, CA, June (2015).

V. Kajorndejnukul, S. Sukhov, and **A. Dogariu**, "*Optical advection*," FTu5F.5, OSA-FIO/LS, San Jose, CA, October (2015).

C. Constant, J. Kimmel, K. Sugaya, and **A. Dogariu**, "*Optically controlled subcellular diffusion,*" FW5E.7, OSA-FIO/LS, San Jose, CA, October (2015).

J.R. Guzman-Sepulveda, and **A. Dogariu**, "*Real-time full characterization of colloidal dynamics*," AF1J.2, CLEO, San Jose, CA, June (2015).

M.I. Akhlaghi-Bouzan, and **A. Dogariu**, "*Stochastic characterization of optical scattering potentials*," FTh4D.5, OSA-FIO/LS, San Jose, CA, October (2015).

J. Chiles, M. Malinowski, A. Rao, S. Novak, **K.A. Richardson,** and **S. Fathpour**, "*Extremely low-loss chalcogenide photonics devices with chlorine-based plasma etching*," CLEO, San Jose, CA, June (2015).

A. Rao, A. Patil, J. Chiles, M. Malinowski, S. Novak, **K.A. Richardson**, P. Rabiei, and **S. Fathpour**, "*Heterogeneous microring and Mach-Zehnder lithium niobate electro-optical modulators on silicon,*" CLEO, San Jose, CA, June (2015).

P. Rabiei, A. Rao, A. Patil, J. Chiles, and **S. Fathpour**, "*Lithium niobate compact photonic devices on silicon substrates*," OSA Advanced Photonics Conference, Boston, MA, June (2015).

J. Chiles and **S. Fathpour**, "*On-chip modulation in the mid-infrared with silicon-on-lithium-niobate photonics*," CLEO, San Jose, CA, June (2015).

S. Fathpour, A. Rao, P. Rabiei, A. Patil, S. Novak, **K.A. Richardson**, J. Chiles, and M. Malinowski, "*Heterogeneous lithium niobate photonics on silicon substrates*," European Materials Search Society (EMRS) Fall Meeting, Warsaw, Poland (2015). ***Invited***

S. Fathpour, "*Silicon photonics beyond the silicon-on-insulator platform*," OSA-FIO/LS, San Jose, CA, October (2015). ***Invited***

I. Divliansky, E. Hale, M. SeGall, D. Ott, **B.Y. Zeldovich**, **B.E.A. Saleh**, and **L.B. Glebov**, "*Achromatic phase elements based on a combination of surface and volume diffractive gratings.*," Components and Packaging for Laser Systems, edited by Alexei L. Glebov, Paul O. Leisher, 93460Q 1-9, SPIE Photonics West, San Francisco, CA, February (2015).

I. Divliansky, E. Hale, M. SeGall, D. Ott, **B.Y. Zeldovich, B.E.A. Saleh,** and **L.B. Glebov.** , "*Achromatic phase elements based on a combination of surface and volume diffractive gratings*," 9345-25, SPIE Photonics West, San Francisco, CA, February (2015).

S. Mokhov, D. Ott, V. Smirnov, I. Divliansky, **B.Y. Zeldovich,** and **L.B. Glebov**, "*Apodized reflective volume Bragg grating for high-resolution spectroscopy,*" 9359-10, SPIE Photonics West, San Francisco, CA, February (2015).

B. Anderson, G. Venus, D. Ott, I. Divliansky, J.W. Dawson, D.R. Drachenberg, M.J. Messerly, P.H. Pax, J.B. Tassano, and **L.B. Glebov**, "*Brightness enhancement of a multi-mode ribbon fiber using transmitting Bragg gratings*," SPIE 9344, Fiber Lasers XII: Technology, Systems, and Applications, 93441W, SPIE Photonics West, San Francisco, CA, February (2015).

Y. Galushko, A. Glebov, **L.B. Glebov**, Y. Kharitonova, I. Mokhun, O. Mokhun, V. Smirnov, and Y. Viktorovskaya, "*Formation of edge dislocation by the computer generated hologram*," Twelfth International Conference on Correlation Optics, edited by Oleg V. Angelsky. 98090I 1-7, SPIE Photonics West, San Francisco, CA, February (2015).

B. Anderson, G. Venus, D. Ott, E. Hale, I. Divliansky, J. Dawson, D. Drachenberg, M. Messerly, P. Pax, J. Tassano, and **L.B. Glebov**, "*Higher order mode selection for power scaling in fiber lasers using transmitting Bragg gratings*," paper 9466-11, Defense, Security and Sensing. Baltimore, MD, April (2015).

B. Anderson, G. Venus, D. Ott, E. Hale, I. Divliansky, D.R. Drachenberg, J. Dawson, M.J. Messerly, P.H. Pax, J.B. Tassano, and **L.B. Glebov**, "*Higher order mode selection for power scaling in laser resonators using transmitting Bragg gratings*," SPIE 9466, Laser Technology for Defense and Security XI, 94660C, Baltimore, MD, April (2015).

M.A. Krainak, A.W. Yu, M.A. Stephen, S. Merritt, **L.B. Glebov**, L. Glebova, A. Ryasnyanskiy, V. Smirnov, X.D. Mu, S. Meissner, and H. Meissner, "*Monolithic solid-state lasers for spaceflight*," SPIE 9342, Solid State Lasers XXIV: Technology and Devices, 93420K, SPIE Photonics West, San Francisco, CA, February (2015).

D. Ott, I. Divliansky, G. Venus, and **L.B. Glebov**, "*Multiwavelength diode laser source based on multiplexed volume Bragg grating notch filters*," 9346-10, SPIE Photonics West, San Francisco, CA, February (2015).

V. Smirnov, D. Ott, I. Divliansky, G. Venus, O. Mokhun, A.L. Glebov, and **L.B. Glebov**, "*New generation of VBGs for efficient spectral beam combination of high power diode lasers*.," 9346-38 SPIE Photonics West, San Francisco, CA, February (2015).

P. Zhao, M. Reichert, T. Ensley, **D.J. Hagan,** and **E.W. Van Stryland,** "*Beam deflection measurements of nondegenerate nonlinear refractive indices in direct-gap semiconductors*," FW3D.7, CLEO, San Jose, CA, June (2015).

P. Zhao, M. Reichert, **D.J. Hagan,** and **E.W. Van Stryland**, "*Measurement of second hyperpolarizability and nuclear rotational response of gas-phase carbon disulfide*," NW4A.37, Nonlinear Optics Meeting, Kauai, HI, July (2015).

M. Reichert, **D.J. Hagan,** *and* **E.W. Van Stryland**, "*Nondegenerate three-photon absorption in GaAs*," Nonlinear Optics Meeting, Kauai, HI, July (2015).

H. Hu, T.R. Ensley, M. Reichert, M.R. Ferdinandus, D. Peceli, O.V. Przhonska, S.R. Marder, A. K-Y Jen, J.M. Hales, J.W. Perry, **D.J. Hagan,** and **E.W. Van Stryland**, "*Optimization of the electronic third-order nonlinearity of cyanine-like molecules for all optical switching,*" SPIE Photonics West, San Francisco, CA, February (2015).

D.J. Hagan, T.R. Ensley, M. Reichert, M.R. Ferdinandus, H. Hu, and **E.W. Van Stryland**, "*New methods for characterizing the nonlinear optical properties of organic materials*.," 13th International Conference on Frontiers of Polymers and Advanced Materials, Morocco, March (2015). ***Keynote Invited***

H. Hu, T.R. Ensley, M. Reichert, M.R. Ferdinandus, D. Peceli, O.V. Przhonska, S.R. Marder, A. K-Y Jen, J.M. Hales, J.W. Perry, **D.J. Hagan,** and **E.W. Van Stryland**, "*Optimization of the electronic third-order nonlinearity of cyanine-like molecules for all optical switching*," SPIE Photonics West, San Francisco, CA, February (2015). ***Invited***

A.A. Syed, M. Reichert, T.R. Ensley, J. Pelc, **D.J. Hagan**, and **E.W. Van Stryland**, "*Temporal dynamics of nonlinear absorption and refraction in crystalline and hydrogenated amorphous silicon*," Nonlinear Optics Meeting, Kauai, HI, July (2015).

T.S. Wang, C. Zhang, A. Aleksov, I.A. Salama, and **A. Kar**, "*Effect of large deflection angle on the laser intensity profile produced by aod scanners in high precision manufacturing*," 34th International Congress on the Applications of Lasers & Electro-optics (ICALEO) Conference, Atlanta, GA, October (2015).

T.S. Wang, C. Zhang, A. Aleksov, I.A. Salama, and **A. Kar**, "*Effect of large deflection angle on the laser intensity profile produced by aod scanners in high precision manufacturing*," pp. 204-212, Advances in Lasers, Optics and Beam Delivery session of Laser Microprocessing Conference, Orlando FL (2015).

A. Hassan, H. Hodaei, W. Hayenga, and **M. Khajavikhan**, D. Christodoulides, "*Enhanced sensitivity in parity-time-symmetric microcavity sensors*," SeT4C.3, OSA Advanced Photonics Conference, Boston, MA, June (2015).

M. Khajavikhan, "*Non-Hermitian exceptional points for laser mode management,*" IEEE Photonics Conference (IPC), Reston, VA, October (2015).
M. Khajavikhan, "*Parity-time symmetric lasers*," IEEE Photonics Conference (IPC), Reston, VA, October (2015).

M.A. Miri, N. Nye, **M. Khajavikhan,** and **D.N. Christodoulides**, "*PT-symmetric scatterers (Presentation Recording),*" SPIE 9546, Active Photonic Materials VII, SPIE Optics & Photonics Conference, San Diego, CA, August (2015).

M. Khajavikhan, D.N. Christodoulides, and H. Hodaei, "*PT-symmetricmicroring lasers,*" Session 31, The Ninth IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory, Athens, GA, April (2015).

W. Hayenga, and M. Khajavikhan,, "Rate equation analysis of high-speed nanolasers," SPIE Photonics West, San Francisco, CA, February (2015).

R. El-Ganainy, **M. Khajavikhan, D.N. Christodoulides**, and L. Ge, "*Supersymmetric laser arrays*," FTh3D.5, CLEO, San Jose, CA, June (2015).

M. Khajavikhan, "*Coaxial nanolasers*," IEEE Summer Topicals, Nassau, Bahamas, July (2015). ***Invited***

M.A. Miri, N. Nye, **M. Khajavikhan,** and **D. N. Christodoulides**, "*PT-symmetric scatterers*," SPIE Photonics West, San Francisco, CA, February (2015). ***Invited***

M. Khajavikhan, H. Hodaei, M.A. Miri, and **D.N. Christodoulides**, "*Single-mode parity-time-symmetric micro-ring lasers*," 28D2-1, Conference on Lasers and Electro - Optics Pacific Rim, Busan South Korea (2015). ***Invited***

C. Lumdee, and **P.G. Kik**, "*Numerical prediction of the effect of nanoscale surface roughness on film-coupled nanoparticle plasmon resonances,*" SPIE 9163, Plasmonics: Metallic Nanostructures and Their Optical Properties XII, 91631I (2015).

J.L. Digaum, J.J. Pazos, R.C. Rumpf, J. Chiles, **S. Fathpour**, J. Thomas, and **S.M. Kuebler**, "*Polarization sensitive beam bending using a spatially-variant photonic crystal*," SPIE 9371, Photonic and Phononic Properties of Engineered Nanostructures V, 9371-16, SPIE Photonics West, San Francisco, CA, February (2015).

Y. Li, N. Hua, X. Zheng, and **G.F. Li,** "*Capex advantages of few-mode fiber networks*," Th2A.43, Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

H. Wen, H.J. Zheng, B.Y. Zhu and **G.F. Li**, "*Experimental Demonstration of Long-Distance Analog Transmission over Few-Mode Fibers*," Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

H. Wen, H. Zheng, B. Zhu, and **G.F. Li**, "*Experimental demonstration of long-distanceanalog transmission over few-mode fibers*," M3E.2, Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

B. Huang, N.K. Fontaine, R. Ryf, B. Guan, S.G. Leon-Saval, R. Shubochkin, Y. Sun, R. Lingle Jr, and **G.F. Li**, "*Mode-group-selective photonic lantern using graded-index multimode fibers*," W2A.9, Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

J. Zhao, N. Zhao and **G.F. Li**, "*SDM using parallelism of free space*," SPIE Photonics West, San Francisco, CA, February (2015).

X. Yuan, and **S. Pang**, "*Coded aperture temporal compressive microscopy*," FTh1F. OSA-FIO/LS, San Jose, CA, October (2015).

Y.Y. Sun, and **S. Pang**, "*Multi-perspective fluorescence talbot microscopy*," FTh3G.6, OSA-FIO/LS, San Jose, CA, October (2015).

C. Schwarz, C. Grabill, B. Gleason, G. Richardson, A. Vyas, S. Labh, C. Rivero-Baleine, **K.A. Richardson**, A. Pogrebnyakov, T. Mayer, and **S.M. Kuebler**, "*Fabrication and characterization of micro-structures created by direct laser writing in multi-layered chalcogenide glasses,*" SPIE 9374, Advances Fabrication Technologies for Micro/Nano Optics and Photonics VIII, 937403-1-9, SPIE Photonics West, San Francisco, CA, February (2015).

I. Mingareev, T. Tetz, C. Fornaroli, A. Gillner, and **M.C. Richardson**, "*Study of mechanisms of high-aspect-ratio groove formation in silicon utilizing ultrafast laser radiation*," M201, ICALEO, Atlanta, GA, October (2015).

B. Sopori, S. Devayajanam, P. Basnyat, R. Schnepf, S. Sahoo, J. Gee, F. Severico, A. Manens, H. Seigneur, **W.V. Schoenfeld**, S. Preece, J. Binns, J. Appel, and K. VanSant, "*Surface damage introduced by diamond wire sawing of si wafers: measuring in-depth and the lateral distributions for different cutting parameters*," 2015 MRS Spring Meeting, San Francisco, CA, April (2015).

K.O. Davis, **W.V. Schoenfeld**, "*APCVD: an enabling technology for manufacturing silicon solar cells*," FL AVS Annual Symposium, Orlando, FL, March (2015). ***Invited***

A. Schülzgen, J. Anderson, C. Jollivet, A. Van Newkirk, K. Schuster, and S. Grimm, "*Multi-core fiber lasers*," LTu2H.2, OSA-FIO/LS, San Jose, CA, October (2015). ***Invited***

A. Schülzgen, A. Van Newkirk, J. Anderson, G. Salceda-Delgado, Z.S. Eznaveh, J.E. Antonio-Lopez, C. Xia, G.F. Li, R.G.H. van Uden, F.M. Huijskens, H. de Waardt, A.M.J. Koonen, C.M. Okonkwo, **R. Amezcua Correa**, "*Multicore fibers*," UF3A.1, OSA 4th Workshop on Specialty Optical Fibers and Their Applications, Hong Kong, November (2015). ***Invited***

A. Van Newkirk, A. Velázquez-Benítez, J.E. Antonio-Lopez, J. Albert, **R. Amezcua Correa,** and **A. Schülzgen**, "*3d bending sensor combining multicore fiber with a mode-selective photonic lantern*," paper: 2345242, OSA 4th Workshop on Specialty Optical Fibers and Their Applications, Hong Kong, November (2015).

A. Van Newkirk, E. Antonio-Lopez, G. Salceda-Delgado, U. Pirracha, **R. Amezcua Correa,** and **A. Schülzgen,** "*A multicore fiber strain sensor with increased sensitivity*," SPIE 9480, Laser Technology for Defense and Security XI, 9480-20, Baltimore, MD, April (2015).

Z.S. Eznaveh, J.E. Antonio-Lopez, G. Lopez-Galmiche, J. Anderson, **A. Schülzgen,** and **R. Amezcua Correa**, "*Asymmetric very large mode area fiber with enhanced higher order mode delocalization*," paper: 2345578, OSA 4th Workshop on Specialty Optical Fibers and Their Applications, Hong Kong, November (2015).

B. Pati, W. Tian, A. Van Newkirk, and **A. Schülzgen**, "*High power WDM with small wavelength separations,*" Stu1N.3, CLEO, San Jose, CA, June (2015).

B. Pati, W. Tian, A. Van Newkirk, and **A. Schülzgen**, "*High power WDM with small wavelength separations,*" Stu1N.3, CLEO, San Jose, CA, June (2015).

K. Al Yahyaei, P. Hofmann, C. Jollivet, A Van Newkirk, **R. Amezcua Correa**, E. Antonio-Lopez, D. Ott, M. SeGall, I. Divliansky, L. Glebova, **L.B. Glebov**, A. Kost, and **A. Schülzgen**, "*Highly photosensitive fiber fabricated from photo-thermo-refractive glass*," 35(8), pp.305, Developments in Strategic Materials and Computational Design V: Ceramic Engineering and Science Proceedings, January (2015).

A. Ryasnyanskiy, V. Smirnov, H. Mingareev, **A. Schülzgen**, A. Glebov, L. Glebova, and **L.B. Glebov**, "*Magneto-optical properties of fluorinated silicate glasses doped with rare earth ions*," SPIE 9466, Laser Technology for Defense and Security XI, 9466-14, Baltimore, MD, April (2015).

J. Anderson, C. Jollivet, A. Van Newkirk, K. Schuster, S. Grimm, and **A. Schülzgen**, "*Multi-core fiber lasers,*" LTu2H.2, OSA-FIO/LS, San Jose, CA, October (2015).
A. Van Newkirk, E. Antonio-Lopez, G. Salceda-Delgado, M.U. Pirracha, **R. Amezcua Correa**, and **A. Schülzgen**, "**Multicore fiber strain sensor with increased sensitivity**," SPIE 9480, Fiber Optic Sensors and Applications XII, 9480-20, Baltimore, MD, April (2015).

A. Schülzgen, A. Van Newkirk, J. Anderson, G. Salceda-Delgado, Z. S. Eznaveh, J. E. Antonio-Lopez, C. Xia, G.F. Li, R. G. H. van Uden, F. M. Huijskens, H. de Waardt, A. M. J. Koonen, C. M. Okonkwo, and **R. Amezcua Correa**, "*Multicore fibers*," paper: UF3A.1, OSA 4th Workshop on Specialty Optical Fibers and Their Applications OSA Technical Digest, Hong Kong, November (2015).

A. Van Newkirk, J.E. Antonio-Lopez, G. Salceda-Delgado, M.U. Piracha, **R. Amezcua Correa,** and **A. Schülzgen**, "*Simultaneous measurement of strain and temperature using high sensitivity multicore fiber*

sensors," SM1L.4, CLEO, San Jose, CA, June (2015).

G. Lopez-Galmiche, Z. Sanjabi Eznaveh, L. A. Herrera-Piad, A. M. Velazquez-Benitez, J. Rodriguez-Asomoza, J. E. Antonio-Lopez, J. J. Sanchez-Mondragon, C. Gonent, P. Sillard, C. Okonkwo, **A. Schülzgen, G.F. Li**, and **R. Amezcua Correa**, "*Six mode erbium-doped fiber amplifier using mode selective photonic lantern*," AM2B.5, Asia Communications and Photonics Conference ACP, Hong Kong (2015).

A.M. Velazquez-Benitez, J.C. Alvarado-Zacarias, G. Lopez-Galmiche, J.E. Antonio-Lopez, **A. Schülzgen**, D. Van Ras, P. Sillard, C.M. Okonkwo, and **R. Amezcua Correa**, "*Six spatial modes photonic lanterns*," W3B.3, Optical Fiber Communications Conference, Los Angeles, CA, March (2015).

K.A. Richardson, C. Smith, J. David Musgraves, P. Wachtel, T. Mayer, A. Swisher, A. Pogrebnyakov, D. Werner, and C. Rivero-Baleine, "*Engineering novel infrared glass ceramics for advanced optical solutions*," 39th International Conference and Expo on Advanced Ceramics and Composites (ICACC) American Ceramic Society, Daytona Beach, FL, January (2015). ***Invited***

K.A. Richardson, "*Transitioning from the laboratory to small business - issues and opportunities,*" American Ceramic Society, Ceramic Expo 2015, Cleveland, OH, April (2015). ***Invited***

A. Sincore, **L. Shah**, and **M.C. Richardson**, "*Resonantly pumped amplification in a thulium-doped large mode area photonic crystal fiber,*" SW1L.3, CLEO, San Jose, CA, June (2015).

A.. Sincore, **L. Shah**, M. Wysmolek, R. Ryan, A. Abdulfattah, and **M.C. Richardson**, "*Resonantly pumped amplification in a Tm-doped large mode-area photonic crystal fiber*," 9344-62, SPIE Photonics West, San Francisco, CA, February (2015).

A. Sincore, **L. Shah**, M. Wysmolek, R. Ryan, A. Abdulfattah, and **M.C. Richardson**, "*Resonantly pumped amplification in a Tm-doped large mode-area photonic crystal fiber*," SPIE 9344, Fiber Lasers XII: Technology, Systems, and Applications, 93441R, SPIE Photonics West, San Francisco, CA, February (2015).

I. Mingareev, S. Berger, T. Tetz, A. Abdulfattah, A. Sincore, **L. Shah**, and **M.C. Richardson**, "*Trans-wafer removal of metallization using a nanosecond Tm:fiber laser*," SPIE 9350, Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XX, 9350-10, SPIE Photonics West, San Francisco, CA, February (2015).

P. Samuel, T.R. Ensley, H. Hu, D.J. Hagan, and E.W. Van Stryland, R. Gaume, "Nonlinear refractive index measurement on pure and Nd doped YAG ceramic by dual arm Z-scan technique," 1665, 060010-1-3, AIP Conference, Solid State Physics, Tamilandu, India, December (2014).

D.J. Hagan and **E.W. Van Stryland**, "*Characterization and modeling of nonlinear refraction and absorption,*" XIV Brazilian MRS, Rio De Janeiro September (2015). ***Invited***

V.O. Smolski, and **K.L. Vodopyanov**, "*Broadband 2.5-6 μm frequency comb source for dual-comb molecular spectroscopy*," SPIE 9347, Nonlinear Frequency Generation and Conversion: Materials, Devices, and Applications XIV, 934702, SPIE Photonics West, San Francisco, CA, February (2015).

V.O. Smolski, S. Vasilyev, P.G. Schunemann, S.B. Mirov, and **K.L. Vodopyanov**, "*Cr: ZnS Laser-pumped subharmonic GaAs OPO with an instantaneous bandwidth 3.6-5.6 μm*," SW4O.2, CLEO, San Jose, CA, June (2015).

V.O. Smolski, S. Vasilyev, P.G. Schunemann, S.B. Mirov, and **K.L. Vodopyanov**, "*Cr:ZnS Laser-pumped subharmonic GaAs OPO with an instantaneous bandwidth 3.6-5.6 μm,*" SW4O.2, CLEO, San Jose, CA, June (2015).

V.O. Smolski, S.D. Gorelov, J. Zhao, J. Xu, P.G. Schunemann, and **K.L. Vodopyanov**, "*Frequency comb spanning 2.5-7.5 μm from a subharmonic GaAs opo and its coherence properties*," STh1N.5, CLEO, San Jose, CA, June (2015).

V.O. Smolski, S.D. Gorelov, J. Zhao, J. Xu, P.G. Schunemann, and **K.L. Vodopyanov**, "*Frequency comb spanning 2.5-7.5 μm from a subharmonic GaAs opo and its coherence properties*," STh1N.5, CLEO, San Jose, CA, June (2015).

K.L. Vodopyanov, "*Nonlinear frequency generation and conversion: materials, devices, and applications XIV,*" SPIE 9347, Nonlinear Frequency Generation and Conversion: Materials, Devices, and Applications XIV, SPIE Photonics West, San Francisco, CA, February (2015).

K.L. Vodopyanov, "*Broadband mid-IR frequency comb source for standoff chemical detection,*" SPIE Defense and Security Conference, Baltimore, MD, April (2015). ***Invited***

P.F. Tekavec, V.G. Kozlov, I. McNee, Y.S. Lee, and **K.L. Vodopyanov**, "*Video rate imaging at 1.5 THz via frequency upconversion to the near-IR,*" SPIE Defense and Security Conference, Baltimore, MD, April (2015). ***Invited***

H. Chen, Y. Gao, and **S.T. Wu**, "*n-FFS vs. p-FFS: Who wins?,*" SID Symposium, 46, pp.735- 738 San Jose, CA, June (2015). ***Invited***

D. Xu, J. Yuan, M. Schadt, J. Yan, and **S.T. Wu**, "*Stabilizing blue phase liquid crystals with linearly polarized UV light*," SPIE 9384, Emerging Liquid Crystal Technologies X, SPIE Photonics West, San Francisco, CA, February (2015). ***Invited***

S. He, J. Fang, and **S.T. Wu**, "*A liquid crystal biosensor for liver diseases,*" 46, pp.147-150, SID Symposium, San Jose, CA, June (2015).
H. Chen, Z. Luo, D. Xu, F. Peng, S.T. Wu, M.C. Li, S.L. Lee, and W.C. Tsai, "A fast-response A-film-enhanced fringe field switching LCDs," 46, pp.656-660, SID Symposium, San Jose, CA, June (2015).

F. Peng, D. Xu, H. Chen, and **S.T. Wu**, "*A low-voltage and fast-response infrared spatial light modulator*," 46, pp.831- 834, SID Symposium, San Jose, CA, June (2015).

Y. Gao, Z. Luo, R. Zhu, Q. Hong, and **S.T. Wu**, et al., "*An LCD with OLED-like luminance distribution*," 46, pp.1584-1587, SID Symposium, San Jose, CA,, June (2015). ***Distinguished student poster***

J. Yuan, D. Xu, and **S.T. Wu**, "*An ultra-low voltage blue phase LCD for mobile applications*," 46, pp.1520-1523, SID Symposium, San Jose, CA, June (2015).

R. Zhu, Z. Luo, and **S.T. Wu**, "*Doubling the light outcoupling efficiency of quantum dot light emitting diodes*," 46, pp.1459- 1461, SID Symposium, San Jose, CA, June (2015).

H. Liang, R. Zhu, and **S.T. Wu**, et al., "*Enhancing the light outcoupling efficiency of quantum-dot light emitting diodes with periodic microstructures*," 46, pp.1472- 475, SID Symposium, San Jose, CA, June (2015).

D. Xu, H. Chen, **S.T. Wu**, M.C. Li, S.L. Lee, and W.C. Tsai, "*Fast-response fringe field switching LCD with patterned common electrode,*" 46, pp.652-655, SID Symposium, San Jose, CA, June (2015).

F. Peng, H. Chen, S. Tripathi, R. J. Twieg, and **S.T. Wu**, "*Fast-response IR spatial light modulators with a polymer network liquid crystal*," 9384, SPIE Photonics West, San Francisco, CA, February (2015).

Z. Luo, F. Peng, H. Chen, M. Hu, and **S.T. Wu**, "*High image quality wearable displays with a fast-response liquid crystal*," 46, pp.1-4, SID Symposium, San Jose, CA, June (2015). ***Distinguished student paper***

D. Xu, J. Yuan, M. Schadt, and **S.T. Wu**, "*High performance blue phase liquid crystals stabilized by linear photopolymers*," 46, pp.545-548, SID Symposium, San Jose, CA, June (2015).

D. Xu, F. Peng, H. Chen, J. Yuan, **S.T. Wu**, M.C. Li, S.L. Lee, and W.C. Tsai, "*Image sticking reduction of fringe field switching LCDs*," 46, pp.739- 742, SID Symposium, San Jose, CA, June (2015).

H. Chen, F. Peng, and **S.T. Wu**, et al., "*Low dielectric constant materials for high performance LCDs*," 46, pp.450-453, SID Symposium, San Jose, CA, June (2015).

Z. Luo, S. Xu, Y. Gao, Y. H. Lee, Y. Liu, and **S.T. Wu**, "*Quantum dots enhanced vivid color liquid displays*," 46, pp.1469- 1471, SID Symposium, San Jose, CA, June (2015).

F. Peng, R. J. Twieg, and **S.T. Wu**, "*Recent advances in IR liquid crystal spatial light modulators*," SPIE 9565, Liquid Crystals XIX, SPIE Optics & Photonics Conference, San Diego, CA, August (2015). ***Keynote presentation***

K. O. Davis, I. Kashkoush, A. Blum, K. Öğütman, E. Schneller, R. A. Sinton, and **W. V. Schoenfeld**, "*Impact of Ozone-Based Cleaning on Surface Recombination with Different Passivation Materials,"* 42nd IEEE Photovoltaics Specialists Conference, DOI: 10.1109/PVSC.2015.7356333, New Orleans, LA, June (2015).

E. Schneller, K. O. Davis, K. Öğütman, and **W. V. Schoenfeld**, "*Considerations in the Extraction of Physically Significant Parameters for Various c-Si Cell Architectures*," 42nd IEEE Photovoltaic Specialists Conference, DOI: 10.1109/PVSC.2015.7356045, New Orleans, LA, June (2015).

A. Ashraf, K. O. Davis, Öğütman, **W. V. Schoenfeld**, and M. D. Eisaman, "*Hyperspectral laser beam induced current system for solar cell characterization*," 42nd IEEE Photovoltaic Specialists Conference, DOI: 10.1109/PVSC.2015.7356129, New Orleans, LA, June (2015).

K. Öğütman, K. O. Davis, E. Schneller, V. Yelundur, and **W. V. Schoenfeld**, "*A Thorough Way of Mapping Efficiency with Photoluminescence*" 42nd IEEE Photovoltaic Specialists Conference, DOI: 10.1109/PVSC.2015.7356041, New Orleans, LA, June (2015)

Invited Lectures and Tutorials

D. Chanda, "*Functional Optical Metamaterials*," CREOL Industrial Affiliates Symposium Short Course (2015).

Z. Chang, "*Attosecond photonics, new frontier in AMO research*," Introduction to Research at CREOL, University of Central Florida, Orlando, FL September (2015). ***Invited***

Z. Chang, "*Driving lasers for next generation attosecond sources*," Institute of Physics, Chinese Academy of Sciences, Beijing, China June (2015). ***Invited***
Z. Chang, "*Fundamentals of theory for attosecond optics research*," State Key Laboratory of Transient Optics and Photonics, Xi'an Institute of Optics & Precision Mechanics, Xi'an, China June (2015). ***Invited***

Z. Chang, "*High energy isolated attosecond pulses,*" Center for Ultrafast Optics, University of Michigan, Ann Arbor, MI February(2015). ***Invited***

Z. Chang, "*Intense isolated attosecond pulse generation with a CEP locked 10 Hz laser*," International Workshop on Intense-field Short-wavelength Atomic and Molecular Processes, ISWAMP-3, Hamburg, Germany July (2015). ***Invited***

Z. Chang, P. Corkum, F. Legare, S. Leone, and D. Neumark, "*Microjoule isolated attosecond pulses for atto pump-atto probe*," DARPA PULSE Review Meeting, Arlington, VA, January (2015). ***Invited***

Z. Chang, P. Corkum, S. Leone, and D. Neumark, "*Microjoule isolated attosecond pulses for atto pump-atto probe*," DARPA PULSE Program Review Meeting, Boulder, CO, September (2015). ***Invited***

Z. Chang, "*Mir opcpa lasers for driving next generation attosecond x-ray sources,"* 2015 Joint-Attosecond-MURI Annual Meeting, University of Central Florida, Orlando, FL, November (2015). ***Invited***

Z. Chang, "*Next Generation Attosecond Light Sources,*" Information Photonics Technology, Xi'an, China, December (2015). ***Invited***

Z. Chang, "*Real-time observation of wavepackets in atoms of molecules*," 2015 Joint-Attosecond-MURI Annual Meeting, University of Central Florida, Orlando, FL, November (2015). ***Invited***

M. Heinrich, M. A. Miri, S. Stützer, S. Nolte, **D.N. Christodoulides**, and A. Szameit, "*Supersymmetric scattering and transformation optics,*" The European Conference on Lasers and Electro-Optics, Munich, Germany, CE-3.1 (2015). ***Invited***

D.N. Christodoulides, "*Beam Synthesis & Dynamics*," CREOL Industrial Affiliates Symposium Short Course, Orlando, FL, March (2015).

E. Cunningham, "*Development of a 10 Hz, CEP-stable 200 TW Ti:sapphire laser for high-flux isolated attosecond pulse production*," ALLS Workshop, Saint-Sauveur, Qc, Canada, June (2015). ***Invited***

P.J. Delfyett, "*Ultrafast laser technologies and applications - from the lab to the market*," Florida Academy of Science Keynote Dinner Talk, St. Leo University, March (2015). ***Invited***

P.G. Kik, "*Nanoparticle gap plasmons: the ideal probe of nanoscale electronic and optical phenomena?*," Discussions on Nano & Mesoscopic Optics, El Chalten, Argentina (2015). ***Invited***

G.F. Li, "*Optical Fiber Communication*," CREOL Industrial Affiliates Symposium Short Course, Orlando FL, March (2015).

K.A. Richardson, "*Advanced photonics based on infrared glass and glass ceramic solutions*," Graduate Seminar, Department of Materials Science and Engineering, Clemson University (2015). ***Invited***

K. Schepler, "Transition-Metal Solid-State Lasers," CREOL Industrial Affiliates Symposium Short Course Orlando FL, March (2015).

E.W. Van Stryland, "Nondegenerate nonlinearities and 3-level models," Foundations of Nonlinear Optics, Lehigh University, Bethlehem, PA, August (2015). ***Invited***

D.J. Hagan and **E.W. Van Stryland**, "*Nonlinear materials characterization and modeling*," US-Israel Emerging Technology, Boston, MA, December (2015). ***Invited***

E.W. Van Stryland and **D.J. Hagan,** "*Separation of electronic and nuclear nonlinearities and modeling of organic materials*," Photonics Middle East Conference, Doha, Qatar, December (2015). ***Invited***

K.L. Vodopyanov, "*Coherent midinfrared sources and applications,*" CLEO Short Course, San Jose, CA, June (2015).

K.L. Vodopyanov, "*Coherent midinfrared sources and applications*," SPIE Photonics West, San Francisco, CA, February (2015). Short Course

S.T. Wu, "*New LCD frontiers*," AU Optronics, Hsinchu, Taiwan, April (2015). ***Invited***

S.T. Wu, "*Recent advances in fringe field switching LCDs*," Tianma Microelectronics, Xiamen, China, April (2015). Invited

S.T. Wu, "*Recent advances in mobile displays,*" China Star Optoelectronics Technology, Shenzhen, China, April (2015). Invited

B.Y. Zeldovich, "*Fundamental properties of electric field vector of light polarization.*," Physics Department, University of Miami (2015). ***Invited***

K. Ogutzman, K. Davis, and **W. V. Schoenfeld,** "*Thorough analyses of different ways of mapping efficiency of silicon solar cells with photoluminescence*," FL AVS Annual Symposium, Young Leaders Session, Orlando, FL, March (2015). ***Invited***

3.6 Patents and Disclosures

Patents

Y.F. Liu, Y.C. Lai, *"Liquid crystal display*," US 9025120 B2 (2015).

R. Amezcua Correa, A. Schülzgen, and J.E. Antonio Lopez , *"Multicore optical fiber for sensing applications,"* WO 2015163963 A3 (2015).

M. Bass, S. Seal, W.T. Self, "*Biocompatible nano rare earth oxide upconverters for imaging and therapeutics*," US 9127202 B1 (2015).

D. Shelton, **G.D. Boreman**, and J. D'Archangel, "*Metamaterial composition comprising frequency-selective-surface resonant element disposed on/in a dielectric flake, methods, and applications*," US 9182519 B2 (2015).

G.D. Boreman, and D. Shelton, "*Tunable optical diffraction grating apparatus and related methods*," US 9182526 B2 (2015).

Z. Chang, Q. Zhang, and K. Zhao, "*Optical system and optical filtering method,"* US 9158176 B2 (2015).

P.J. Delfyett, "*Laser ablation method and apparatus having a feedback loop and control unit,"* US 9,022,037 (2015).

D.G. Deppe, "*Composite semiconductor light source pumped by a spontaneous light emitter,"* US 9118162 B2 (2015).

G.F. Li, C. Xia, and N. Bai, "*Systems and methods for optical transmission using supermodes,"* US 9103961 B2 (2015).

M. Wei, R.C. Boutwell, and **W.V. Schoenfeld**, "*Photodetectors based on wurtzite MgZnO,"* US 9059417 B1 (2015).

R.C. Boutwell, M. Wei, and **W.V. Schoenfeld**, "*UV photodetectors having semiconductor metal oxide layer,"* US 9112074 B2 (2015).

L. Shah, J.M. Bovatsek, A.Y. Arai, T. Yamamoto, R.S. Patel, and D.J. Harter, "*Femtosecond laser processing system with process parameters, controls and feedback*," US 9147989 B2 (2015).

L. Shah, and M.E. Fermann, "*Ultrashort laser micro-texture printing,"* US 8,995,029 (2015).

L.H. Rao, **S.T. Wu**, and Y.C. Lai, "*Display panel,"* US 9140937 B2 (2015).

J. Yan, D. Xu, H. C. Cheng, **S.T. Wu**, Y. F. Lan, and C. Y. Tsai, "*Optical films and display devices having the same,"* US 9,121,999 B2 (2015).

Provisional/Utility

P.J. Delfyett, A. Klee, and K. Bagnell, "*An ultra-low noise mode-locked laser using a coupled optoelectronic oscillator and optical frequency division*," Patent Pending 06/08/2015 62/172,488 (2015).

A.F. Abouraddy, "*Dynamic in-fiber particle production with precise dimensional control*," Patent Pending 09/10/2015 2634/MUMNP (2015).

A.F. Abouraddy, S.E. Banaei, J. Kaufman, S.Shabahang, and G. Tao, "*In-fiber particle generation (US)*," Patent Pending 01/14/2015 14/414,715 (2015).

A.F. Abouraddy, "*Polymeric fiber luminescent solar concentrators*," Patent Pending 11/04/2015 62/250,570 (2015).

A.F. Abouraddy, A. Dogariu, J. Kaufman, R. Rezvani Naraghi, S. Sukhov, and F. Tan, "*Structured granular composite materials, method of fabrication, and applications*," Patent Pending 11/16/2015 14/942,042 (2015).

A.F. Abouraddy, W. Larson, L. Martin, L. Pye, S. Shabahang, and M. Villinger, "*Ultra-high absorption of incoherent light over large bandwidths in systems that have low intrinsic absorption in that range,*" Patent Pending 11/16/2015 62/255,765 (2015).

R. Amezcua Correa, J. Antonio-Lopez, and **A. Schülzgen**, "*Multicore optical fiber apparatus, methods, and applications,*" Patent Pending 02/04/2015 PCT/US2015/014356 (2015).

M. Baudelet, "*Quantitative elemental profiling in optical emission spectroscopy,*" Patent Pending 02/13/2015 14/622,046 (2015).

Z. Chang, "*Method for suppressing parasitic lasing in cryocooled laser amplifier*," Patent Pending 08/03/2015 14/816,166 (2015).

D.G. Deppe, "*Diffused channel light sources and optical data networks therefrom*," Patent Pending 05/20/2015 14/717,692 (2015).

A. Dogariu, R. Rezvani Naraghi, and S. Sukhov, "*Plate type concentrator with high light guiding efficiency,*" Patent Pending 01/23/2015 62/106,893 (2015).

J. Chiles and **S. Fathpour**, "*Method for producing high-index-contrast and mechanically stable air-clad optical waveguides by deep-trench etching and wafer bonding*," Patent Pending 12/21/2015 62/270,221 (2015).

R. Gaume and S. Chen, "*Optical polymer composites, methods and applications,*" Patent Pending 03/19/2015 PCT/US2015/021374 (2015).

I. Divliansky, **L.B. Glebov**, E. Hale, **B.E.A. Saleh**, and **B.Y. Zeldovich**, "*Achromatic holographic phase masks,*" Patent Pending 02/10/2015 62/114,297 (2015).

L.B. Glebov, E. Hale, D. Ott, G. Venus, B. Anderson, and I. Divliansky, "*Optical system including multiplexed volume bragg grating, methods, and applications*," Patent Pending 08/28/2015 14/838,744 (2015).

P.G. Kik, "*Transparent electrode optical device, method and applications*," Patent Pending 07/24/2015 14/807,934 (2015).

G.F. Li and H. Wen, "*Analog fiber-optic links using high-order fiber modes*," Patent Pending 03/23/2015 62/136,848 (2015).

G.F. Li, and H. Wen, "*Digital fiber-optic link apparatus, methods, and applications*," Patent Pending 05/28/2015 62/167,397 (2015).

W.V. Schoenfeld, "*LED backlight apparatus and method*," Patent Pending 01/29/2015 14/608,562 (2015).

Y. Gao, Z.Y. Luo, and **S.T. Wu**, "*Micro-structure films for sunlight readble displays*," Patent Pending 06/03/2015 201510298596.2 (2015).

Y.H. Lee, and **S.T. Wu**, "*Optical system with controllable image distance*," Patent Pending 11/23/2015 62/258,707 (2015).

Disclosures

M. Bass, "*Laser soldering and microwelding tool*," 08/27/2015 (2015).

R. Gaume and W. Shoulders, "*Airtight container for the fabrication of atmosphere sensitive materials by compaction*," 02/05/2015 (2015).

R. Gaume and S. Chen, "*Transverse oscillation suppressor for solid-state gain-media*," 07/23/2015 (2015).

L.B. Glebov, B. Anderson, I. Divliansky, E. Hale, D. Ott, and G. Venus, "*Method of spatial mode conversion using multiplexed volume bragg gratings*," 04/20/2015 (2015).

P.G. Kik, "*Spatially multiplexed/interleaved dielectric metasurface optical elements*," 09/15/2015 (2015).

S. Pang, "X-*ray phase-contrast and dark-field information extraction with electric fringe scanning and/or active pixel processing*," 07/21/2015 (2015).

K.A. Richardson, "*Multi-scale molding of glass components*," 02/09/2015 (2015).

M.C. Richardson, "*The laser-plasma hohlraum XUV radiation source*," 03/12/2015 (2015).

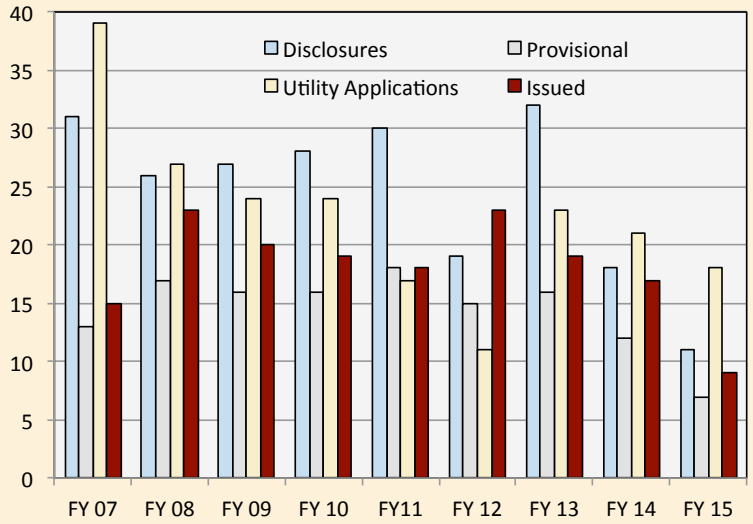
L. Shah, R. Amezcua Correa, J. Antonio-Lopez, and J. Bradford, "'*Coherent' photonic lanterns for fiber lasers,*" 08/10/2015 (2015).

H.W. Chen and **S.T. Wu**, "*Blue phase liquid crystal display with improved temperature sensitivity,*" 12/15/2015 (2015).

G. Tan, **S.T. Wu**, and R. Zhu, "*High ambient contrast ratio display device*," 09/29/2015 (2015).

J. Zhu, H.W. Chen, Y.H. Lee, and **S.T. Wu**, "High transmittance and sunlight readable films," 12/09/2015 (2015).

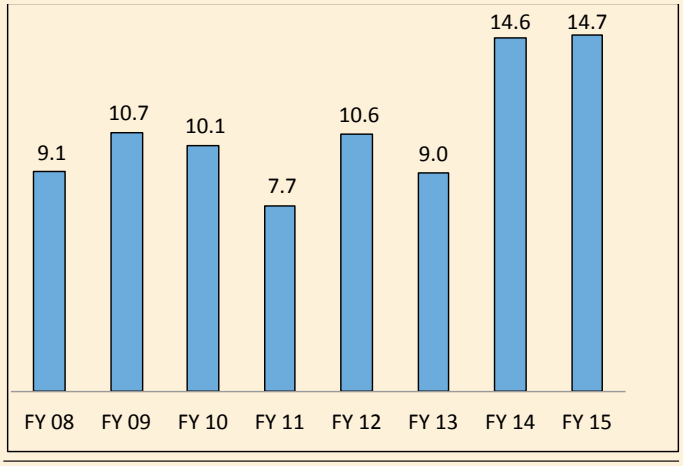
H.W. Chen and **S.T. Wu**, "*In plane switching liquid crystal display with trapezoid electrodes*," 12/17/2015 (2015).



History of disclosures, applications, and issued patents

3.7 Research Funding

Research has been funded by a combination of federal, industrial, and state grants. The amounts shown below are actual funds received for each year, with each grant covering a different period. Some of the industrial grants include federal funding that has come via industry. Not included in the chart of funding history are the state grants. A $10M fund was received in FY 2004 for the Florida Photonics Center of Excellence (FPCE) and a $4.5M grant received in FY2007 to establish the Townes Laser Institute (TLI). These funds continue to support the research and educational activities of these centers.



History of funding ($M) in FY 2008–2015

Grants received in FY 2015

Federal	$12,117,603
Federal through industry	$1,038,382
Industry R&D	$1,031,145
International	$466,889
Foundation	$54,918
Total	$14,708,937

Research Funding (FY 2015)

Recipient	Source	Title of Award	Period	Awarded 2015
Abouraddy, A.	Massachusetts Institute of Technology	Harnessing in-fiber fluid instabilities for scalable and universal multidimensional nanosphere design, manufacturing, and applications	12/1/2014-10/31/2015	$88,702
Abouraddy, A., Aita, G.	University of Rochester	Exploiting Multidimensional Classical Optical Entanglement for Enhanced Spatial Scene Recognition	6/1/2014-5/31/2016	$118,989
Abouraddy, A., Schepler, K.	National Science Foundation (NSF)	PFI: AIR-TT Robust Multimaterial Chalcogenide Infrared Optical Fibers	4/15/2015-9/30/2016	$176,000
Amezcua Correa, R.	Open Photonics, Inc.	Two Mode Optical Fiber	1/12/2015-11/12/2015	$24,999
Amezcua Correa, R., Schulzgen, A.	Asymmetric Medical Ltd	Optical Fiber for Medical Applications	8/1/2014-12/5/2014	$23,030
Amezcua Correa,R., Glebov, L., Richardson, M., Schulzgen, A., Shah, L.	US Army Research Office	Fiber Laser Light Engines - A New Platform to Collectively Address Power-limiting Constraints	8/20/2012-2/19/2018	$192,970
Bass, M.	Powerlase Photonics, Ltd	Preliminary design and performance modeling of a Seed laser, PCF and rod-amplifier	4/21/2014-8/31/2014	$15,241
Bass, M.	Element Six LTD	Single Crystal Diamond Absorption Measurements	12/10/2014-1/31/2015	$1,500
Bass, M.	Powerlase Photonics, Ltd	The M and W slabs	11/3/2014-12/17/2014	$14,497
Chang, Z.	US Army Research Office	High flux isolated attosecond XUV source	9/10/2012-9/9/2015	$43,103
Chang, Z.	Defense Advanced Research Projects Agency (DARPA)	Microjoule-level isolated attosecond pulses for atto pump-atto probe	7/25/2013-11/14/2016	$1,026,960
Chang, Z.	The Regents of The University of California	Post-Born-Oppenheimer Dynamics Using Isolated Attosecond Pulses	7/21/2014-7/20/2017	$360,980
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	$918,750
Christodoulides, D.	University of Arizona	Mathematical Modeling and Experimental Validation of Ultrafast Nonlinear Light-Matter Couping Associated with Filamentation in Transparent Media	9/30/2010-10/15/2015	$76,456
Bass, Dr. Michael	"No Needles Venipuncture	Single Crystal Analysis Laser Calorimetry	1/30/2014-3/1/2014	$1,500

Christodoulides, D.	Georgia State University	Novel Nonlinear Optical Processes in Active, Random, And Nanostructured Systems	7/1/2013-5/31/2016	$230,057
Christodoulides, D.	United States-Israel Binational Science Foundation	Sub-wavelength Linear and Non-Linear Optics	10/1/2011-9/30/2016	$14,720
Christodoulides, D., Abouraddy, A.	US Air Force Office of Scientific Research (AFOSR)	MURI: PT-Symmetric Optical Materials and Structures	10/15/2013-1/14/2017	$1,486,865
Christodoulides, D., Richardson, K.	Lockheed Martin Missiles and Fire Control	Advanced Optical Filters and Coatings, Phase 2	5/13/2015-12/1/2015	$25,000
Crabbs, R.	Radiance Technologies	Testing Support at Eglin Air Force Base	3/27/2014-9/24/2016	$33,554
Delfyett, P.	National Science Foundation (NSF)	Coherent Ultrafast Optical Signal Processing Using Stabilized Optical Frequency Combs	6/1/2015-5/31/2018	$360,000
Delfyett, P., Fathpour, S.	The Regents of The University of California	Heterogeneously Integrated Optical Synthesizer (H-iOS)	3/31/2015-9/30/2016	$275,840
Deppe, D.	DOD/Army/Army Research Office	WDM Nanoscale Laser Diodes for Si Photonic Interconnects	2/1/2012-12/31/2015	$100,000
Dogariu, A.	National Institutes of Health (NIH)	Development of Multimodal Correlation Imaging Microscopy for Cell Biology	9/1/2014-6/30/2017	$327,311
Dogariu, A.	Malvern Instruments Ltd	LCDLS Technology Development and Tests	7/1/2013-7/1/2016	$166,901
Dogariu, A.	Hill-Rom Services, Inc.	Optical Assessment of Tissue Damage	5/5/2015-2/5/2016	$38,000
Dogariu, A.	National Institutes of Health (NIH)	Real-time monitoring of blood viscoelasticity index during cardiopulmonary bypass	4/1/2015-3/31/2017	$122,601
Dogariu, A., Abouraddy, A.	Sherwin Williams Company	Composite Optics Scatter	9/1/2014-12/31/2015	$198,319
Fathpour, S.	Office of Naval Research	Hybrid Second-Order Nonlinear Photonic Devices on Silicon	5/20/2013-12/31/2016	$170,500
Fathpour, S., Delfyett, P., Deppe, D., Khajavikhan, K., Schoenfeld, W.	Office of Naval Research	DURIP: Acquisition of an Advanced Plasma-Enhanced Chemical Deposition System	6/13/2014-12/31/2015	$324,043
Gaume, R.	University of California/ Lawrence Berkeley National Laboratory (LBNL)	BaBrI:Eu2+ and other Ba-based bright scintillators as transparent ceramics: a multi-institutional approach	4/16/2013-3/31/2016	$46,410
Gaume, R.	Duke University	High-throughput computational and experimental search of novel phonon mediated covalent metal superconductors and thermoelectric materials	10/1/2011-3/31/2015	$43,648
Glebov, L.	US Army Research Office	DURIP: Laser Setup for Volume Diffractive Optical Elements Recording in Photo-Thermo-Refractive Glass	8/1/2014-11/30/2015	$149,900

Glebov, L., Schulzgen, A., Zeldovich, B.	US Air Force Office of Scientific Research (AFOSR)	Volume Bragg Gratings - Research, Testing and High Power Applications	9/27/2010-12/26/2015	$500,000.00
Hagan, D., Van Stryland, E.	Government of Israel: Ministry of Defense	Development of new materials for strong, broadband nonlinear transmission (Years 3-5)	7/28/2009-5/1/2016	$100,000
Kapat, J., Gordon, A., Mingareev, I., Raghavan, S.	Aerojet Rocketdyne, Inc.	RF: Selective Laser Melted (SLM) Superalloy Processing, Characterization and Properties for Energy Systems	9/10/2014-11/30/2014	$10,000
Khajavikhan, M.	National Science Foundation (NSF)	CAREER: Novel Photonic Structures Using Non-Hermitian Exceptional Points	3/1/2015-2/29/2020	$500,000
Khajavikhan, M., LiKamWa, P.	US Army Research Office	Design and Development of Electrically Pumped Coaxial Nanoscale Laser for On-Chip Optical Communication	9/1/2014-5/31/2015	$50,000
Kik, P.	NanoSpective	RF - Research Nanophotonic Material and Devices	7/1/2011-4/15/2018	$250
Kuebler, S.	Academy of Applied Science	High School Traineeship via AEOP/REAP 2015	4/14/2015-9/30/2015	$1,350
Kuebler, S.	Semplastics, LLC.	RF: Preparation of a Reflective Surface Using a Microporous Substrate	7/21/2014-12/20/2014	$449
LiKamWa, P.	Nufern	Monolithic Photonic Integrated Chip	4/1/2015-12/30/2015	$10,000
Li, G., Abouraddy, A., Amezcua Correa, R., Richardson, M., Schulzgen, A., Bai, Y.	Harris Corporation	Monolithic Multimaterial Buoyant Optical Fiber Cable	3/4/2015-5/31/2016	$308,000
Li, G., LiKamWa, P.	Hong Kong FSPhotonics Technology Limited	Linear and Nonlinear Properties of Multimode SOAs	1/1/2015-12/30/2015	$40,000
Li, G., Saleh, B.	National Science Foundation (NSF)	ST-ODT: Spatiotemporal Optical Diffraction Tomography	7/1/2015-6/30/2018	$369,993
McKee, M.	OSA Foundation	LITE: Learning light through Inquiry, Teaching, and Experimenting	12/5/2014-1/15/2016	$8,000
Mingareev, I.	Made in Space, Inc.	Microcast: Additive Manufacturing of Metal Plus Insulator Structures with Sub-MM Features	7/30/2014-12/19/2014	$30,949
Richardson, K.	Lockheed Martin Missiles and Fire Control	Broadband Gradient Index (GRIN) Optics	12/1/2014-12/31/2015	$400,000
Richardson, K.	Lockheed Martin Missiles and Fire Control	Low dn/dt materials with enhanced thermal mechanical properties	4/1/2014-12/1/2014	$90,000
Richardson, K.	Various	RF K. Richardson Equipment Use Account	1/1/2015-12/31/2015	$875
Richardson, K., Gaume, R., Sohn, Y.	Asian Office of Aerospace Research and Development (AOARD)	DURIP: Advanced Parallel Beam X-Ray Diffractometer for Optical Materials Research	9/9/2014-9/8/2015	$420,178
Richardson, M.	KLA-Tencor Corporation	DUV Laser Plasma Studies	10/10/2011-10/1/2015	$14,500
Richardson, M.	Inertial Labs, Inc	Next Generation Laser Training Systems	11/1/2012-10/1/2016	$230,879
Richardson, M.	University of Maryland/ College Park	Optical Turbulence Instrumentation	8/15/2012-11/14/2016	$752,099
Richardson, M.	UCF Foundation, Inc	TOWNES LASER INSTITUTE - UCF Foundation Gifts	7/1/2014-6/30/2016	$50

Richardson, M., Baudelet, M.	US Air Force Office of Scientific Research (AFOSR)	Fundamentals of Filament Interaction	10/15/2010-8/14/2016	$242,107
Richardson, M., Baudelet, M. Durand, M.,Shah, L.	US Army Research Office	DURIP: MOBILE ULTRAFAST HIGH ENERGY LASER FACILITY (MU-HELF)	10/15/2014-10/14/2016	$600,000
Richardson, M., Baudelet, M., Chang, Z., Jeon, C.	DOD/Army/Army Research Office	Light Filamentation Science	8/1/2011-9/20/2016	$874,276
Richardson, M., Shah, L.	University of North Carolina	Novel GMRF devices for integration with Tm:fiber lasers	12/1/2010-11/30/2015	$70,116
Saleh, B.	UCF Foundation, Inc	CREOL - UCF Foundation Gifts	7/1/2014-6/30/2016	$45,267
Schoenfeld, W.	Agnitron Technology, Inc.	Phase II STTR: Molecular Beam Epitaxy Grown Wurtzite MgZnO Solar Blind Detectors	9/29/2014-9/29/2016	$300,000
Schoenfeld, W., Seigneur, H., Davis, K., Walters, J.	US Photovoltaic Manufacturing Consortium, Inc (PVMC)	PV Manufacturing Consortium	9/1/2011-8/31/2016	$219,002
Shah, L., Amezcua Correa, R., Richardson, M., Schulzgen, A.	US Air Force Research Laboratory (AFRL)	Ultralarge mode Ho:PCF - a path towards 10 MW peak powers in fibers, with >30mJ energy, and >250W average power	3/24/2015-8/30/2016	$284,064
Van Stryland, E., Hagan, D.	Georgia Tech Research Corporation	MURI: Nonlinear Optical Characterization	9/30/2010-3/31/2016	$216,717
Vodopyanov, K.	Office of Naval Research	Novel concept of frequency-combs interferometric spectroscopy in the mid-IR for significantly enhanced detection of explosives	5/1/2014-9/30/2015	$162,000
Vodopyanov, K. Schepler, K.	Q-Peak Inc.	Few-optical-cycle LWIR laser system	8/25/2014-2/10/2015	$50,000
Wu, S.	Office of Naval Research	Low-Absorption Liquid Crystals for Infrared Beam Steering	10/23/2012-9/30/2015	$163,964
Wu, S.	Kent Optronics, Inc.	Fast-response SWIR liquid crystals	10/23/2014-10/31/2015	$40,000
Wu, S.	Industrial Technology Research Institute (ITRI)	Novel Display and Biosensor Devices	12/1/2011-12/31/2016	$91,000
Wu, S.	US Air Force Office of Scientific Research (AFOSR)	Submillisecond-response liquid crystal spatial light modulators	9/1/2014-8/31/2019	$152,000
			Total	**$14,708,937**

Most funded faculty in 2015

Twenty nine researchers in areas ranging from optics, medicine, psychology, and education were recognized by UCF in 2015 in what has become a much-anticipated campus tradition – induction into the UCF Millionaires Club. Six CREOL faculty were inducted.


Ayman Abouraddy


Zenghu Chang


Demetrios Christodoulides


Kathleen Richardson


Martin Richardson


Winston Schoenfeld

3.8 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), an MS Program in Biotechnology, and a new MS Professional Science in Biotechnology. The interdisciplinary PhD and MD-PhD 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

Florida Space Institute is located at the space center, in Brevard County in East Central Florida, so as to provide a focus on space for the research and education programs of its institutional members. Classrooms, faculty offices and laboratories are located at the Kennedy Space Center Visitors Center, in the Astronaut Memorial Foundation's Center for Space Education facility. While the academic program is at the core of FSI, providing Masters and Ph.D. level programs of study, the Institute also has a strong engineering support staff, and performs research on contracts and grants, providing real-life opportunities for student research and thesis projects. The organizational structure also encourages research on the individual campuses of the member schools, allowing the development of space hardware, and then "flowing" that hardware through the FSI facilities at the space center for processing and then on to space flight. Since its founding in 1990 as a consortium of state universities, community colleges, and private schools, the consortium has expanded, and now counts as its members UCF, Florida Institute of Technology, Brevard Community College, Embry-Riddle Aeronautical University, Florida Agricultural & Mechanical University, University of Miami, Florida Atlantic University, University of South Florida, University of Florida, and Broward Community College. Additionally, through NASA's Florida Space Grant Consortium program resident with FSI, some 16 additional universities and colleges throughout Florida enjoy an indirect relationship with the Institute.

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.

ICAMR
International Consortium for Advanced Manufacturing Research

The International Consortium for Advanced Manufacturing Research (ICAMR) is the world's only consortium focused on the manufacturing development of next generation smart sensors, photonics, and advanced devices thought the integration of novel materials and 3-D stacking. ICAMR serves as an open-innovation, semiconductor based platform, for the development of advanced systems and devices through collaborative programs and shared access to next generation materials (III-Vs and others), state-of-the-art processing equipment, new metrology and testing platforms, and a complete systems and design center. ICAMR is in the process of building one of the most advanced labs/fabs in the world to support manufacturing development of these emerging technologies just south of the Orlando Airport in Osceola County. This 100,000 square-foot facility will have state-of-the-art cleanroom facilities and services to accommodate the manufacturing development of a wide range of emerging technologies. The Systems and Design Center will be launched mid-2016 to support product and PDK development, with the first cleanroom equipment sets being installed in the manufacturing development facility early 2017. Greater than $200M has already been invested in the infrastructure and initial operations. The core process tool sets being selected will enable UCF, industry, and other ICAMR partners to develop some of the most leading edge materials and processes ever integrated into a CMOS based platform.

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)

4. Partnership and Outreach

One of the major objectives of UCF is to be the leading Partnership University in the nation in the 21st century. To fulfill this mission, the College has formed strong bonds with industry, has become a major force in Florida's laser and photonics community, and is a prime source of highly educated talent in the optics and photonics field. The faculty members participate in the formulation and execution of a wide variety of outreach programs and public service activities.

4.1 Industrial Partnership

Since its early years, CREOL has benefited from a strong partnership with industry and 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. CREOL is an active partner with the Florida Photonics Cluster (FPC), which supports the growth and profitability of the photonics industry in Florida.

The Industrial Affiliates Program

The College has established a large industrial affiliates program (with current membership of **66** companies, sustained over many years). 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 The College of Optics and Photonics. 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).
- 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 CREOL, The College of Optics & Photonics Highlights quarterly newsletter
- Special recognition at the annual Industrial Affiliates Day
- Listing in other CREOL, The College of Optics & Photonics publications, where appropriate, including on CREOL, The College of Optics & Photonics website (with a link to the company's website)
- Company name plaque prominently displayed in the entrance lobby of the CREOL building of CREOL, The College of Optics & Photonics

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 in the Center for Research & Education in Optics & Lasers (CREOL) and the Florida Photonics Center of Excellence (FPCE), UCF facilities include the following major research centers:

- Nano-Sciences & 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, The College of Optics & Photonics connects. Through the IA program, your company 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.

2015 Industrial Affiliates Members

Life Members

Cobb Family Foundation
Northrop Grumman Corporation
Nufern

Memoriam Members

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

Medallion Members

Breault Research
Lasersec Systems Corporation
Northrop Grumman Laser Systems
Optical Research Associates
Paul G. Suchoski, Jr

Senior Members

AFL Global
Amplitude*
Coherent, Inc.
CST of America
DataRay, Inc
Edmund Optics
LAS-CAD GmbH
Lockheed Martin
Newport Corporation
Open Photonics
Ophir-Spiricon
Optimax Systems, Inc
Radiant Zemax, LLC
Tektronix
TRUMPF, Inc.
V & N
Zygo Corporation

Affiliate Members

Aerotech Inc.
ALIO Industries
Analog Modules
Asphericon*
eVision, LLC
FLIR Systems Inc.*
Gentec-EO, Inc
Gooch & Housego, LLC
Harris Corporation
HORIBA Jobin Yvon
IRadiance Glass, Inc
JENOPTIK Optical Systems Inc
Laser Institute of America
Lee Laser, Inc
Ocean Optics
Optigrate Corp.
OIDA
Photonics Media
Photonics Online
Plasma-Therm
Princeton Instruments
QPC Lasers/Laser Operations LLC
SCD USA
Sciperio, Inc.
SPIE
StellarNet, Inc
OSA
Thorlabs
Tower Optical Corporation
Thorlabs
TwinStar Optics, Coatings & Crystals
ULVAC Technologies, Inc
Yokogawa Corporation of America
Zomega Terahertz Corporation

* New members

Industrial Affiliates Day

The CREOL Industrial Affiliates Day brings in optics companies from around the country to learn about the ongoing research, recruit students, and identify new partnering opportunities. The 2015 event, held on March 12 - 13 2015, drew over 240 attendees including industrial affiliates, guests from industry and academia, representatives from photonics professional societies, faculty and students, and 25 exhibitors. The theme of the technical symposium was " Advances in Optics & Photonics ", celebrating the International Year of Light. Four technical sessions covered advances in fiber photonics, integrated photonic and sensors, bioimaging, and mid IR. 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, a public lecture entitled "Evolving Lasers to Solve Problems" was given by well known science and technology writer, Jeff Hecht.

The symposium was preceded by four short courses, student talks, tours of the CREOL facilities, and viewing of student posters featuring research of 39 graduate and undergraduate students. The Best Poster Award went to two graduate students, Matthiew Reichert for his poster entitled "Extremely Nondegenerate Two-Photon Gain: Potential for Two-Photon Semiconductor Lasers.", and Amy VanNewkirk for her poster entitled "Multi-Parameter Sensing using Seven-Core Fiber". The Student of the Year Award went to Jeffery Chiles. This year, four short courses were offered (see list on the next page) on Thursday, March 12. 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 and now the Vice-President for Research and Commercialization at UCF. The festivities included great fellowship and great Cajun cuisine.

2015 Industrial Affiliates Day Program

Short Courses 9:00 AM–12:15 P

9:00-10:30AM, CREOL Building, Room 102
Functional Optical Metamaterials
Instructor: Debashis Chanda, Asst. Professor, NSTC & CREOL, UCF

Metamaterials are artificially engineered materials with unique electromagnetic properties. Various new properties like negative refractive index, zero index, artificial magnetism, perfect absorption etc have been demonstrated which are not available in natural materials. However, to date no practical application has emerged based on such properties, primarily due to lack of control and fabrication challenges. The present course will cover the fundamental physics of a chosen set of metamaterials and demonstrate various control mechanisms to tune the optical responses dynamically in order to develop infrared detectors, bio-sensors and flexible displays based on practical large area fabrication techniques.

9:00-10:30AM, HEC Room 125
Transition-Metal Solid-State Lasers
Instructor: Kenneth L. Schepler, Research Professor, CREOL UCF

The course covers fundamental principles of transition-metal ion spectroscopy, semiconductor host materials, transition-metal infrared lasers and their applications. Performance of transition-metal infrared lasers such as Cr2+:ZnSe/S and Fe2+:ZnSe will be reviewed including cw, gain-switched, and modelocked operation. Recent advances in waveguide operation will also be reviewed. Broadband tunability and operation in a multitude of formats leads to applications which encompass infrared spectroscopy, sensing, imaging, free-space communications, infrared countermeasures and high-field effects.

10:45-12:15PM CREOL Building, Room 102
Optical Fiber Communication
Instructor: Guifang Li, Professor, CREOL, UCF

How does fiber optical communication support exponential growth in data traffic on the internet? This course describe key technological revolutions that have provide multiplicative growth of transport capacity of fiber-optic transmission systems in the last two decades. Space-division multiplexing, a focus of current research which could potentially provide the next 100x improvement in transmission capacity, will be presented.

10:45-12:15PM HEC Room 125
Beam Synthesis & Dynamics
Instructor: Demetrios Christodoulides, Pegasus Professor Cobb Family Endowed Chair, CREOL, UCF

The course will cover recent developments in beam shaping and synthesis techniques. Special emphasis will be given to optical diffraction-free patterns and accelerating beams. Possible applications of such wavefronts will be also discussed.

Student Talks 1:30 PM–2:30 PM HEC125

1:30	Hybrid Integrated Photonic Platforms and Devices	Jeffrey Chiles, Student of the Year
	Carrier-Envelope Phase Locked Ultrahigh Power Lasers	Eric Cunningham
	Ultrafast Nonlinear Dynamics of Molecules	Matthew Reichert
	Transverse Mode Selection and Brightness Enhancement of a Fiber Laser using Transmitting Bragg Gratings	Brian Anderson

Poster Session, Lab Tours & Exhibits 2:30 PM–4:30 PM CREOL 102&103

	Student poster session	CREOL rooms 102 & 103
	Exhibits	CREOL Lobby
	Lab Tours	Tours start from CREOL lobby

Reception and Poster Awards Presentation 4:30 PM–5:00 PM CREOL Lobby

Friday, 13 March, Morning Session –UCF Student Union, Pegasus Ballroom

8:00	Continental Breakfast and Walk-in Registrations		
8:30	Welcoming Remarks	Dale Whittaker MJ Soileau	Provost and Vice President Vice President for Research, UCF
8:40	Welcome and Overview	Bahaa Saleh	Dean & Director, CREOL, UCF

Technical Symposium

Session I. Fiber Photonics – Guifang Li, Session Chair

9:15	High Speed Optical Networks for Global Telecom Carriers	Tiejun Xia	DMTS, Verizon Communications
9:45	Multimaterial Chalcogenide Fibers for Mid-Infrared Applications	Ayman Abouraddy	CREOL, UCF
10:05	BREAK & EXHIBITS		

Session II. Integrated Photonics and Sensors– Axel Schulzgen, Session Chair

10:25	Radio Frequency Photonics and Integration Technologies	Arthur Paolella	Harris Corp.
10:55	Novel Fibers and Fiber Devices for Sensing Applications	Rodrigo Amezcua	CREOL, UCF

Session III. Bioimaging – Aristide Dogariu, Session Chair

11:15	Quantitative Phase Imaging: Metrology Meets Biology	Gabriel Popescu	UIUC
11:45	Scalable Large Field-of-View Fluorescence Microscopy	Shuo Pang	CREOL, UCF
12:00	**LUNCH Served-Student Union**		

Session IV. Mid IR – Peter Delfyett- Session Chair

1:00	Monolithic QCL Arrays for Portable High Performance Spectroscopy	Mark Witinski	President, Eos Photonics
1:30	Frequency Combs for Ultrasensitive Molecular Sensing	Konstantin Vodopyanov	CREOL, UCF
	Exhibits – Student Union		

Friday Afternoon Session

Presentations – Pegasus Ballroom, Student Union

International Year of Light -- Public Lecture

1:50	Evolving Lasers to Solve Problems	Jeff Hecht	Science and technology writer
2:45–3:30	**RECEPTION**		

Student Posters

Brian Anderson, Mode selection in a ribbon fiber using transmitting Bragg gratings.

James Anderson, Characterization of a Seven-Core Fiber Laser Based on Supermode Interference.

Josh Bradford, Thermal Mode Instability.

Yan Cheng, Quantum Beats in Attosecond Transient Absorption of Krypton Autoionizing States.

Jeff Chiles, Guided cellular motion using linearly polarized light.

Colin Constant, Two-photon photovoltaic effect in gallium arsenide.

Eric Cunningham, Carrier-envelope phase locked ultrahigh power lasers.

Kris Davis, Atmospheric Pressure Chemical Vapor Deposition: An Enabling Technology for Manufacturing Silicon Solar Cells.

Jennifer Digaum, Three-Dimensional Polarization-Sensitive Spatially-Variant Self-Collimating Photonic Crystal for Beam Bending.

Zeinab Eznaueh, Bi-directional pump configuration for increasing thermal modal instabilities threshold in high power fiber amplifiers.

Yating Gou, Quantum-dots enhanced liquid crystal displays.

Chris Grabill, Improving energy harvesting using plasmonic optical horns.

Evan Hale, Achromatic phase elements based on a combination of surface and volume diffractive gratings.

Danielle Harper, Plasma Density of Laser Filament.

Hossein Hodaei, On-Chip PT-Symmetric Microring Lasers.

Cheonha Jeon, Spatial Dependence of the Interaction between a Single Aerosol and Laser Filament on its Reformation.

Daniel Kepler, Filament-Filament Interaction.

Esat Kondakci, Tailoring photon statistics in disordered photonic lattices by variation of deterministic structured illumination.

A. Lepicard, Control of surface reactivity in borosilicate glasses using thermal poling.

Jie Li, A Mid-IR OPCPA laser system.

Gisela Lopez-Galmiche, Negative Curvature Hollow Core Fiber.

Chatdanai Lumdee, Gap-Plasmon Enhanced Gold Nanoparticle Photoluminescence.

Marcin Malinowski, Extremely Low-Loss Chalcogenide Integrated Photonics with Chlorine Plasma Etching.

Himansu S. Pattanaik, Scanning 3-D mid-IR imaging of buried structures in an uncooled wide bandgap photodiode using extremely nondegenerate two-photon absorption.

Ashutosh Rao, Heterogeneous Microring and Mach-Zehnder Modulators Based on Lithium Niobate and Chalcogenide Glass on Silicon Substrates.

Matthew Reichert, Extremely Nondegenerate Two-Photon Gain: Potential for Two-Photon Semiconductor Lasers.

Farnood Rezaei, Plasmonic photo-capacitive spectral imager.

Alireza Safaei, Extraordinary light absorption on graphene.

Casey Schwarz, Properties of direct laser written nano-structures in multi-layered chalcogenide glasses.

Brandon Seesahai, Plasma Temperature Measurements in the Context of Spectral Interference.

Rashi Sharma, Rhodamine-B intercalated Mica aligned with magnetic field for luminescent solar concentrators.

Robert Short, Engineered Structures of Laser Filaments.

Taylor Shoulders, Barium Chloride Scintillator Ceramics.

Alex Sincore, Resonantly Pumped Thulium-doped Photonic Crystal Fiber Amplifier.

Amy VanNewkirk, Multi-Parameter Sensing using Seven-Core Fiber.

Abraham Vazquez-Guardado, Chiral Light-Matter Interaction.

A. M. Velazquez-Benitez, Photonic Lanters Mode Multiplexers.

Ben Webb, Divided Pulse Amplification.

Peng Zao, Beam Deflection Measurements of Transient Nonlinear Refraction from Coherent Rotational Revivals in Air.

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 2014 clients:

- LC Matter Corp. (Sebastian Gauza, www.lcmatter.com,) 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.
- Plasmonics, Inc. (David Shelton, www.plasmonics-inc.com) 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.
- sdPhotonics LLC (Dennis Deppe, Sabine Freisem) is an emerging leader in the development of high power laser diode technologies that provide improved power, efficiency, brightness and reliability.
- Partow Technologies, LLC, (Payam Rabiei) is developing compact high-speed lithium niobate modulators for data-center and telecommunication applications. The company technology is based on nano-waveguides made in thin film lithium nionbate on silicon substrates. The devices can fit into small form factor transceivers used in data-centers and in telecommunication coherent systems. and reliability.

Industrial Projects

Recipient	Source	Title of Award	Period	Awarded 2015
Amezcua Correa	Open Photonics, Inc.	Two Mode Optical Fiber	1/12/2015-11/12/2015	$24,999
Amezcua Correa, Schulzgen	Asymmetric Medical Ltd	Optical Fiber for Medical Applications	8/1/2014-12/5/2014	$ 23,030
Bass, M.	Element Six LTD	Single Crystal Diamond Absorption Measurements	12/10/2014-1/31/2015	$1,500
Bass	Powerlase Photonics, Ltd	Preliminary design and performance modeling of a Seed laser, PCF and rod-amplifier	4/21/2014 8/31/2014	$15,241
Bass	Powerlase Photonics, Ltd	The M and W slabs	11/3/2014-12/17/2014	$14,497
Christodoulides, Richardson, K.	Lockheed Martin Missiles and Fire Control	Advanced Optical Filters and Coatings, Phase 2	5/13/2015-12/1/2015	$25,000
Crabbs	Radiance Technologies	Testing Support at Eglin Air Force Base	3/27/2014-9/24/2016	$33,554
Dogariu	Hill-Rom Services, Inc.	Optical Assessment of Tissue Damage	5/5/2015-2/5/2016	$38,000
Dogariu	Malvern Instruments Ltd	LCDLS Technology Development and Tests	7/1/2013-7/1/2016	$166,901
Dogariu, Abouraddy	Sherwin Williams Company	Composite Optics Scatter	9/1/2014-12/31/2015	$198,319

Glebov, Schulzgen	OptiGrate Corporation	Magnetooptical isolator for free space and waveguide applications operating at 0.4-5 µm	6/30/2014-1/31/2015	$45,000
Kapat, Gordon, Mingareev, I., Raghavan	Aerojet Rocketdyne, Inc.	RF: Selective Laser Melted (SLM) Superalloy Processing, Characterization and Properties for Energy Systems	9/10/2014-11/30/2014	$10,000
Kik	NanoSpective	RF - Research Nanophotonic Material and Devices	7/1/2011-4/15/2018	$250
Kuebler	Semplastics, LLC.	RF: Preparation of a Reflective Surface Using a Microporous Substrate	7/21/2014-12/20/2014	$449
LiKamWa	Nufern	Monolithic Photonic Integrated Chip	4/1/2015-12/30/2015	$10,000
Li, Abouraddy, Amezcua Correa, Richardson, M., Schulzgen, Bai	Harris Corporation	Monolithic Multimaterial Buoyant Optical Fiber Cable	3/4/2015-5/31/2016	$308,000
Li, LiKamWa	Hong Kong FSPhotonics Technology Limited	Linear and Nonlinear Properties of Multimode SOAs	1/1/2015-12/30/2015	$40,000
McKee	OSA Foundation	LITE: Learning light through Inquiry, Teaching, and Experimenting	12/5/2014-1/15/2016	$8,000
Mingareev, I	Made in Space, Inc.	Microcast: Additive Manufacturing of Metal Plus Insulator Structures with Sub-MM Features	7/30/2014-12/19/2014	$30,949
Richardson, K.	Lockheed Martin Missiles and Fire Control	Broadband Gradient Index (GRIN) Optics	12/1/2014-12/31/2015	$400,000
Richardson, K.	Lockheed Martin Missiles and Fire Control	Low dn/dt materials with enhanced thermal mechanical properties	4/1/2014-12/1/2014	$90,000
Richardson, K.	Various	RF K. Richardson Equipment Use Account	1/1/2015 12/31/2015	$875
Richardson, M.	Inertial Labs, Inc	Next Generation Laser Training Systems	11/1/2012-10/1/2016	$230,879
Richardson, M.	KLA-Tencor Corporation	DUV Laser Plasma Studies	10/10/2011-10/1/2015	$14,500
Richardson, M.	UCF Foundation, Inc	TOWNES LASER INSTITUTE - UCF Foundation Gifts	7/1/2014-6/30/2016	$50
Saleh	UCF Foundation, Inc	CREOL - UCF Foundation Gifts	7/1/2014-6/30/2016	$45,268
Schoenfeld	Agnitron Technology, Inc.	Phase II STTR: Molecular Beam Epitaxy Grown Wurtzite MgZnO Solar Blind Detectors	9/29/2014-9/29/2016	$300,000

Schoenfeld	US Photovoltaic Manufacturing Consortium, Inc (PVMC)	PV Manufacturing Consortium	9/1/2011-8/31/2016	$219,003
Van Stryland, Hagan	Georgia Tech Research Corporation	MURI: Nonlinear Optical Characterization	9/30/2010-3/31/2016	$216,717
Vodopyanov, Schepler	Q-Peak Inc	Few-optical-cycle LWIR laser system	8/25/2014-2/10/2015	$50,000
Wu	Industrial Technology Research Institute (ITRI)	Novel Display and Biosensor Devices	12/1/2011-12/31/2016	$91,000
Wu	Kent Optronics, Inc.	Fast-response SWIR liquid crystals	10/23/2014-10/31/2015	$40,000

Industrial Affiliates members providing financial support for research projects

Visitors from Industry

Gordon Snyder, OP-TEC, January 5, 2015

Allan Mense, Raytheon Missile Systems, January 26, 2015

Dr. Ferrini-Mundy, Director of the National Science Foundation, January 30, 2015

Giuseppe D'Aguanno, AEgis Technologies, March 3, 2015

Peter Schunemann, BAE Systems, March 5, 2015

Rupal Varshneya, Night Vision Labs, March 11, 2015

Paul Mirabella, GE, March 19, 2015

Brian Kim, Stratos Genomics, Inc., April 1, 2015

Hossein Lavasani, Qualcomm-Atheros, April 8, 2015

Natalee Greene, Lockheed Martin, April 9, 2015

Mohammad Soltani, Raytheon, May 8, 2015

Philip Kim, SeungJin Lee, GyeongHun Baek, LG Electronics, Korea, May 20, 2015

Kyle Renshaw, Northrop Grumman Corp., May 26, 2015

Elizabeth Ramirez, Dave Porter, Metro Orlando EDC, May 29, 2015

Gerald Uyeno, Raytheon, June 4, 2015

Steve Whalley, Bette Cooper, TSensors, June 24, 2015

Ulrike Fuchs, Asphericon GmbH, August 8, 2015

Glenn Wagner, Astrobit Corp., September 18, 2015

Brett Kurzman, Wiley Publishing, November 12, 2015

4.2 Alumni Relations

CREOL maintains an ongoing relationship with its alumni. The online CREOL Highlights Newsletter, which is produced several times a year, is distributed to all alumni and alumni profiles and alumni news are posted on the CREOL website. Alumni are invited to the Industrial Affiliates Day and alumni reunions are held at various locations during key meeting of professional societies. In 2015, a reunion was hosted on February 9 during the SPIE Photonics West meeting in San Francisco (at The Thirsty Bear Restaurant) with about 85 guests attending. At the CLEO meeting in San Jose, the alumni reunion was held on May 11 at the Gordon Biersch Brewery Restaurant.

Ed Schons, Winston Schoenfeld and Mike Macedonia attend the PW15 Alumni Reunion

Frank J. Effenberger Receives the 2015 Professional Achievement Award

Frank J. Effenberger is considered a world expert in the field of fiber access networks and passive optical networks. In 2008, he became the chairman of International Telecommunication Union, the United Nations' specialized agency for information and communication technologies. In 2011, he was named as Huawei Fellow, and, in 2015, he was named as a fellow of both the OSA and the IEEE. He holds 60 U.S. patents. Before joining his current company in 2006, Frank was a systems engineer at Motorola. Prior to that, he served at Quantum Bridge Communications, where he managed the system engineering group. He also held other positions in the fiber optics industry, with Science Application International Corporation, Bell Communications and Discovery Semiconductors. He earned his undergraduate in engineering and engineering physics in 1988 at the Stevens Institute of Technology in Hoboken, N.J., and a master's degree in optics from the University of Rochester in 1989, ranking first in his class.

Frank J. Effenberger (right) and Bahaa Saleh at the Black & Gold Gala

4.3 Outreach

Government Visitors

- Joseph Tischler, NRL, April 16, 2015
- Olaf Krawczyk, Ministry for Economics, Labour and Transport of Niedersachsen, Germany, May 22, 2015
- Bill Martin, Osceola County, June 24, 2015
- William Timmer, NIH Program Director (NCI), October 16, 2015

Visitors from Universities and Research Centers

- Tony F. Heinz, Stanford University January 15, 2015
- Kerry Vahala, California Institute of Technology, January 30, 2015
- Sywert Brongersma , IMEC, February 5, 2015
- Xingjie Ni, University of California, Berkeley, March 30, 2015
- Ardavan Oskooi, University of Michigan, April 2, 2015
- Michael Sealy, University of Alabama, April 6, 2015
- Vladislav Yakovlev, Georgia State University, April 7, 2015
- Suxing Hu, University of Rochester, April 8, 2015
- Parag Deotare, MIT, April 9, 2015
- Victor Tseng, University of Florida, April 9, 2015
- Jarred Heigel, Penn State University, April 13, 2015
- Jay Choi, University of Illinois, April 15, 2015
- Luca Argenti, Universidad Autonoma de Madrid (UAM), April 16, 2015
- Arkadiy Lyakh, University of California, April 17, 2015
- Wei-Chuan Shih, University of Houston, April 20, 2015
- Kosmas Tsakmakidis, University of California, Berkeley, April 22, 2015
- Dong Lin, Purdue University, April 24, 2015
- Peter Herman, University of Toronto, Canada, May 1, 2015
- Jennifer Kehlet Barton, University of Arizona, May 6, 2015
- Ryan Gelfand, University of Victoria, Canada, May 28, 2015
- Kyu Young Han, University of Illinois at Urbana-Champaign, June 1, 2015
- Patrick Koelsch, University of Washington, June 5, 2015
- Kyu Young Han, University of Illinois at Urbana-Champaign, July 2, 2015
- Heike Ebendorff-Heidepriem,University of Adelaide, Australia, July 10, 2015
- Bert Byxelinckx, imec Holst in Eindhoven, October 23, 2015
- Wenshan Cai, Georgia Tech, November 24, 2015

Outreach

Jan.-Dec. 2015: Fourteen presentations to students in Introduction to Engineering courses at Seminole State College, Eastern Florida State College, and Valencia College.

Mar. 21, 2015: Hosted the Florida Science Olympiad State Tournament for nearly 2000 students.

Jan. 28, 2015: International Year of Light workshop for teachers, 25 attendees

Oct. 22-24, 2015: Hosted a booth display at the Florida Association of Science Supervisors in Tallahassee.

Sept. 21, 2015: Presentation at Advisor Transfer Conference for 150 attendees.

Oct. 8, 2014: Attended the Knights Degree Expo at Valencia State College

Nov. 18, 2015: International Year of Light workshop for teachers, 10 attendees

Dec. 2015: Produced a 164 page book of labs and demonstrations for K-12 teachers

Fraunhofer-Townes Partnership

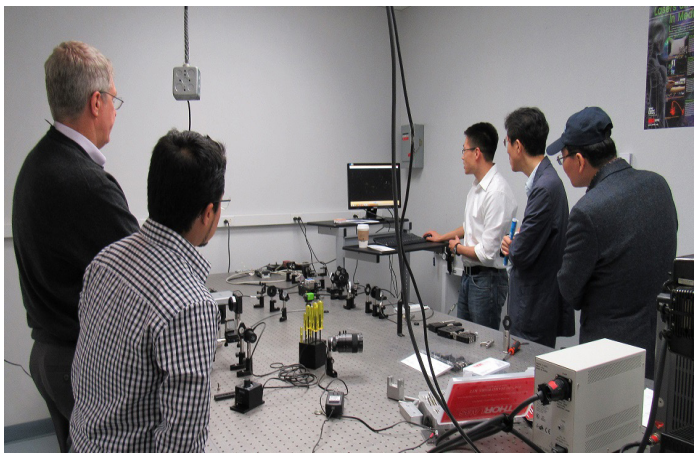
Research and academic collaboration between the Townes Laser Institute and the Fraunhofer Institute for Laser Technology (ILT), RWTH Aachen University (Germany) was established in August 2009. Under this collaboration agreement a joint research program in the fields of laser development, material processing, novel system technology, and life sciences has been created, including the exchange of scientist and students.

Fraunhofer ILT is the leading industrial laser and laser applications facility in Europe. For more than 20 years, ILT has stood for concentrated expertise in the field of laser technology. The innovative solution to manufacturing and production problems, the development of new technical components, competent consultancy and training, highly specialized personnel, the latest technology as well as an international reputation: all these factors make for long-term partnerships.

Fraunhofer ILT's interdisciplinary research activities cover a wide range of areas such as the development of new laser beam sources and components, the use of modern laser measurement and testing technology and laser-supported manufacturing. This includes for example laser cutting, caving, drilling, welding and soldering as well as surface treatment, micro-processing and rapid-prototyping. Furthermore, ILT's research involves laser plant technology and versatile system technology including process control. Besides solving questions of laser technology, the institute develops high-energy sources for soft X-rays for use in semiconductor production and in X-ray microscopy.

The close contact to the Department of Laser Technology at the RWTH Aachen University ensures that a continuous access to a wide knowledge base in the field of laser technology is ensured. RWTH Aachen University has achieved international recognition in several fields of engineering and science, currently ranked the first place in Germany in the fields of mechanical engineering, electrical engineering, and computer science. Several scientists affiliated with RWTH Aachen have won world-wide acclamations, including Nobel Prizes in physics and chemistry.

Graduate student Yuan "Esther" Chen (front) giving a tour of the Liquid Crystal Display Laboratory.



Assistant Professor Shuo (Sean) Pang giving a tour of his Optical Imaging System Laboratory.

International Year of Light Activities

Bringing Light to STEM Teacher Workshop - January 28, 2015

CREOL, The College of Optics and Photonics at the University of Central Florida, offers a workshop for teachers on the Light Blox activity kit developed by the Optical Society (OSA). The workshop includes content on the basics of waves, light, and optics that are correlated to the Florida Science State Standards. For more information see www.creol.ucf.edu

STEM Day Celebrating the International Year of Light - January 30, 2015

The University of Central Florida opens its doors to Central Florida Schools to honor STEM Activities around the campus. To celebrate the International Year of Light, CREOL, The College of Optics and Photonics, hosts light-based demonstrations for elementary and middle school students, with lab tours open for high school students. Students receive diffraction grating glasses and teachers receive curricular notes for use in their classrooms focusing on waves, light, lasers, and optical fibers. For more information see http://stem.cos.ucf.edu/k-12-stem-outreach/stem-day.

CREOL Industrial Affiliates Symposium - March 12 - 13, 2015

CREOL, The College of Optics and Photonics at the University of Central Florida, hosts its Industrial Affiliates Symposium, a two day meeting of industry leaders and photonics researchers with short courses, poster sessions, technical talks, exhibits, and lab tours. Special events celebrating the International Year of Light include public lectures. For more information see www.creol.ucf.edu

Optics Day - April 23, 2015

Student groups at CREOL, The College of Optics and Photonics at the University of Central Florida, welcome area schools and members of the UCF community to tour labs, listen to special presentations, and interact with hands-on exhibits. Includes a special laser light show, curriculum for teachers, and giveaways for students. For more information visit http://caos.creol.ucf.edu/

Capturing Light Photo Contest - March - August 2015

CREOL, The College of Optics and Photonics at the University of Central Florida, invites students to take pictures and send in their best photos that represent the word "Light". Photos will be judged by College faculty and staff with a reception for winners in August 2015. For more information see www.creol.ucf.edu

The First Book of Light - November 17, 2015

Dean Bahaa Saleh from CREOL, The College of Optics and Photonics at the University of Central Florida, presents a talk on the First Book of Light, The Book of Optics, first published in 1015 by Ibn Al-Haytham. Along with this presentation, faculty from the UCF Department of History will talk about major milestones in the history of light, optics, and photonics. For more information see www.creol.ucf.edu

Florida Science Olympiad - March 21, 2015

CREOL, The College of Optics and Photonics at the University of Central Florida, helps sponsor the Florida Science Olympiad State Tournament where students will compete in several light based events. Science Olympiad is a national competition in which teams of fifteen students each compete in twenty-three different STEM events. Students originate from 84 schools around the State of Florida. For more information see www.floridascienceolympiad.org

CREOL sponsors Florida Science Olympiad where students compete in several light based events. Science Olympiad is a national competition in which teams of 15 students each compete in 23 different STEM events. Over 200 schools compete.

K-12 Curriculum Materials

The OSA Foundation / The Optical Society awarded a grant of $8000 to create a curriculum manual containing 40 lesson plans and demonstrations for science teachers in grades K-12. The book has activities ranging from using light as a fingerprint to lenses and mirror basics. The book is available online and in print form for a limited distribution to teachers. 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.

Students at the Florida Science Olympiad Awards Ceremony, March 21, 2015.

5. CREOL Association of Optics Students

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 six optics and photonics societies: OSA-The Optical Society, IEEE-Photonics Society, SPIE-The International Society for Optics and Photonics, SID-The Society for Information Display, WiLO-Women in Lasers and Optics, and SOS Society of Optics Students.
Inaugurated on March 18, 2015, SOS (Society of Optics Students) is a UCF registered student organization that will be a member of the now 7 student organizations at CREOL. 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.

5.1 Officers

Elected officers of CAOS and the professional societies' student sections in 2014-2015 are listed below:

CAOS

SID Member:	Daniel Franklin (chair)
IEEE-PS Member:	Juan He
OSA Member:	Roxana Rezvani
SOS Member:	Josie Lorenzo
SPIE Member:	Naman Mehta
WiLO Member:	Sambhav Anand

IEEE photonics SOCIETY

President:	Jiamin Yuan
Vice President:	Juan He
Treasurer:	Roman Grigorev
Secretary:	Guanjun Tan
Webmaster:	Nitesh Dhasmana

OSA

President:	Javed Rouf Talukder
Vice President:	Roxana Rezvani
Treasurer:	Midya Parto
Secretary:	Ali Abdulfattah
Webmaster:	Laura Sisken

SPIE

President:	Alex Sincore
Vice President:	Naman Mehta
Treasurer:	Steffen Wittek
Secretary:	Roman Grigorev
Webmaster:	Colin Constant

Society of Optics Students

President:	Sean Crystal
Vice President:	Josie Lorenzo
Treasurer:	Benjamin Stuart
Secretary:	Nitesh Dhasmana
Webmaster:	Joshua Perlstein

SID

President:	Haiwei Chen
Vice President:	Daniel Franklin
Treasurer:	Yun-Han Lee
Secretary:	Nitesh Dhasmana
Webmaster:	Joshua Perlstein

WiLO

President:	Amy Van Newkirk
Vice President:	Sambhav Anand
Treasurer:	Walker Larson
Secretary:	Naman Mehta

5.2 Educational Outreach

Bringing Light to STEM Teacher Workshop - January 28, 2015

The College of Optics and Photonics offers a workshop for teachers on the Light Blox activity kit developed by the Optical Society of America. The workshop includes content on the basics of waves, light, and optics that are correlated to the Florida Science State Standards.

Teachers participate in a workshop sponsored by CREOL in celebration of the International Year of Light

STEM Day Celebrating the International Year of Light – January 30, 2015

The University of Central Florida opens its doors to Central Florida Schools to honor STEM Activities around the campus and the International Year of Light. The College of Optics and Photonics hosts light-based demonstrations for elementary and middle school students, with lab tours open for high school students. Students receive diffraction grating glasses and teachers receive curriculum for use in their classrooms that focus on waves, light, optics, and photonics.

Students from local schools participate in STEM Day

Science Day – February 27, 2015

WiLO joined with the Physics Women's Society to host 140 Eagle Academy Corner Lake Middle School students for a day full of science. The students watched a photonics video, saw demonstrations in both CREOL and the Physics building, and played a game using lasers and mirrors. The theme of the event was "Science in your Life", so each demonstration had a direct application to something used in our everyday lives

Florida Science Olympiad –March 21, 2015

The College of Optics and Photonics helps sponsor the Florida Science Olympiad State Tournament where students will compete in several light based events. Science Olympiad is a national competition in which teams of fifteen students compete in twenty-three different STEM events. Students originate from 84 schools around the state of Florida.

Optics Day 2015 – April 24, 2015

One of the world's leading institutions for research and education in optics and photonics is right here at UCF. CREOL (The College of Optics and Photonics) is opening its doors for a fun-filled day of lab tours & optic demos! Ever seen a real-life hologram? Or the individual LCD pixels on your iPhone? Optics Day is guaranteed to be a fascinating, interactive, and educational experience!

MJ Soileau attends Optics Day

Peter Delfyett showing students how to make a white-light hologram

SWEet College Day – April 18, 2105

WiLO assisted the Society of Women Engineers with their SWEet College Day for high school girls. Fifty girls came to CREOL and participated in optics demonstrations as well as the Hit the Target laser and mirror game. The girls were also introduced to life in college and CREOL's various degree programs.

AFRL Site Visit for PRISM – April 27, 2015

In response to the $110M Integrated-Photonics Institute for Manufacturing Innovation (IP-IMI) funding opportunity, CREOL led a proposal to create the Photonics Research Institute for Sustainable Manufacturing (PRISM), an industry led consortium geared towards the development of advanced manufacturing platforms and capabilities for integrated photonics. On behalf of more than 115 industry/government/academic partners across the entire integrated photonics ecosystem, CREOL submitted a concept paper and was successfully down-selected as one of 3 finalists invited to submit a full proposal. On March 27 and 28, CREOL and partner Georgia Tech hosted a site visit by the DoD review panel, and with many of the PRISM partners present, provided an overview of PRISM to the panel. The team is currently awaiting final selection by the DoD, expected in late June

Dignitaries from Germany – May 22, 2015

CREOL hosted a visit by Mr. Olaf Krawczyk, Ministry for Economics, Labor and Transport from Niedersachsen, Hannover Germany. The visit was requested by the offices of the Mayor of Orange County, Teresa Jacobs. The meeting resulted from a request to the Mayor by Enterprise Florida-Germany office, to assist Mr. Krawczyk, in connecting with R&D institutions in the field of field of photonics and optics as well as measurement technology.

CREOL/LETI Workshop – September 8-9, 2015

CREOL was visited by a team from LETI on September 8-9, 2015. This was a 2-day technical workshop with 15 talks that related to LETI's Optics and Photonics research.

Introduce a Girl to Photonics Day – October 10, 2015

IEEE sponsored a national Introduce a Girl to Photonics Day in celebration of the International Year of Light. While events were happening all around the country, CREOL held its own event with middle school girls from various local Girl Scout Troops. The girls were introduced to photonics with demonstrations and games, explaining basic optics concepts

Sichuan Engineering Technical College in China visit CREOL – October 29,2015

15 Professors from Sichuan Engineering Technical College in China visited CREOL on October 29th 2015. Dr. Saleh presented an overview of the facilities and the guests toured several labs.

Professors from Sichuan Engineering Technical College

UCF Conference on Sensor Devices and Applications – October 30, 2015

The UCF Conference on Sensor Devices and Applications is a one-day workshop organized by CREOL, The College of Optics and Photonics; the College of Engineering & Computer Science, and the Nanoscience Technology Center as a forum for UCF faculty engaged in research in sensor technologies and related fields to exchange ideas and explore possibilities for collaborative interdisciplinary research. The scope of the conference is broad, including electronic, integrated-photonic, optical fiber, thin-film, polymer, plasmonic, acoustic, thermal, mechanical (MEMS/NEMS), microfluidic, chemical, bio-, and neuro-sensors. Technologies include single-chip, wireless, networked, smart, nano, remote, embedded, passive, and active sensors. Topics related to materials, manufacturing, and packaging are also included.

SWE Mystery Design – November 21, 2015

The Society of Women Engineers held their annual Mystery Design event for middle school girls, and WiLO held one of the workshops in CREOL. The girls were introduced to the concepts of optical fiber, the color spectrum, lens design, and optical communications through demonstrations and games.

5.3 Professional Development

OSA/SPIE/IEEE-PS Joint Seminar: Jean-luc Doumont – February 23, 2015

In this presentation, Jean-luc Doumont gave his perspective on effective communications. His talk proposes and illustrates three simple yet solid ideas that lead to more effective communication and that underpin every other guideline: easy to remember, readily applicable, and always relevant-in short, valuable for the rest of your life.

US Army Night Vision and Electronic Sensors Directorate Information Session - March 11, 2015

Two members of the US Army Night Vision and Electronic Sensors Directorate presented their research on a variety of sensor projects. The work presented focused on advanced electro-optic and infrared sensor technology. They also outlined numerous opportunities for students for future full time or internship positions.

Career Paths in Optics: Panel Discussion - April 10, 2015

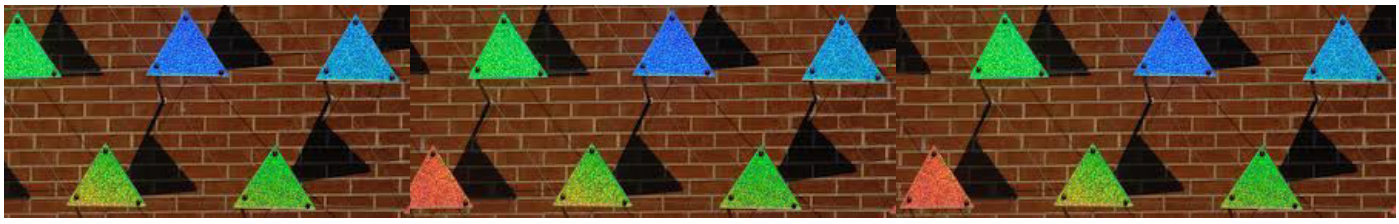
WiLO invited three professional women in the optics field to CREOL to discuss their career paths and experiences. On the panel were CREOL professor, Mercedeh Khajavikhan, Senior Research Engineer at Lockheed Martin, Clara Rivero-Baleine, and Director and Chief Operating Officer of Irradiance Glass, Inc., Jennifer McKinley. They discussed differences in academia vs. industry, why they chose their current position, and gave advice to the students on choosing the correct career for them.

Jennifer Barton - May 6, 2015

WiLO invited Jennifer Barton, Professor and Associate Vice President for Research at the University of Arizona, to speak to CREOL students about her research, as well as personal career experience. She presented her research, which focuses on optical imaging with Optical Coherence Tomography and Bioinstrumentation. After the presentation, she participated in an informal question and answer session with students, where she outlined her career path and gave advice on many of the questions students will soon be facing when starting their careers in the field of optics.

SOS Professional Development Presentation: Igor Volkov & Jessica Carter – October 28, 2015

SOS hosted a professional development presentations from the Faculty Coordinator at the Office of Experimental Learning: Igor Volkov, and the Assistant Director at Career Services: Jessica Carter. Together they discussed how to network, attain career services, and writing the best resumes both in paper and on improving your LinkedIn page.



5.4 Seminars and Symposia

OSA Graduate Research Symposium

In this series of talks sponsored by the student chapter of OSA at CREOL, graduate students presented on research they've been conducting at CREOL. The purpose of this symposium is to internally educate our researchers, promote collaboration, and give students practice at presenting. With 10 graduate student speakers in 2015, these talks have spanned 10 research groups covering the vast breadth of activities here at CREOL.

Jan. 21, 2015	"IR detection and IR imaging in wide-gap semiconductors using extremely nondegenerate two photon absorption" by Himansu Patanik "2D fermionic Hong-Ou-Mandel interference with massless Dirac fermions" by Mahtab Khan
April 15, 2015	"Fabrication of titanium oxide Magnéli phase nanoceramics for thermoelectric applications" by Sudeep Jung Pan "Thermal modal instabilities in high power fiber amplifiers" by Zahoora Sanjabi
May 21, 2015	"Liquid crystal based biosensors for the detection of bile acids" by Sihui He "Heterogeneous microring and Mach-Zehnder modulators based on lithium niobate and chalcogenide glasses on silicon" by Ashutosh Rao
Oct. 7, 2015	"Controlling diffusion with light" by Colin Constant "Designing optical properties in Infrared glasses" by Benn Gleason
Nov. 18, 2015	"Imaging solar cells via Photoluminescence" by Kortan Ogutman "Multicore Fiber Lasers" by James Anderson

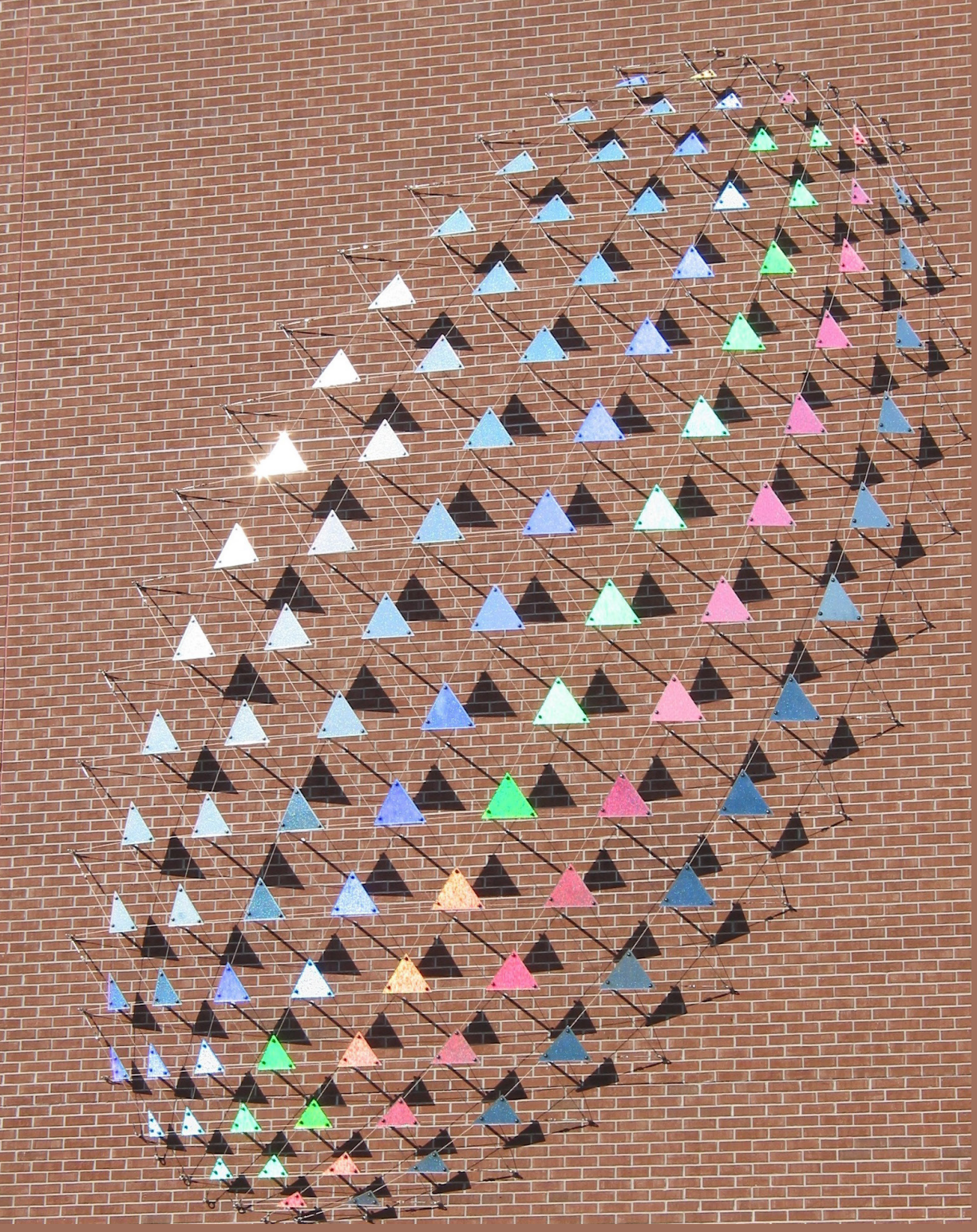
SPIE Faculty Talk Series

In this series of talks sponsored by the student chapter of SPIE at CREOL, faculty members give a non-technical talk geared around professional development, soft skills, broader persepctives, etc. These talks provide an intimate setting to better know the CREOL faculty, while simultaneously passing down knowledge from career experts.

April 24, 2015	"Living the interdisciplinary dream – in a discipline-specific world" by Dr. Kathleen Richardson
June 11, 2015:	"A Creole boy goes to CREOL: Many hands make light work" by Dr. M.J. Soileau
Aug. 21, 2015	"The Modern World – We Owe It To Physics" by Dr. Michael Bass
Oct. 23, 2015	"Tiny neutral ones – neutrinos" by Dr. Michael Bass
Dec. 11, 2015	"Long and Sinuous Way in Optics Research" by Dr. Leonid Glebov

CAOS Organized Seminars

				Sponsor
1/29/2015	Pao-Tai Lin	MIT's Microphotonics Center and Department of Materials Science and Engineering	"See Chem-Bio Molecules in New Light: Mid-Infrared Materials & Nanophotonics"	OSA
2/20/2015	Qiong-Hua Wang	Sichuan University	"Glasses-free 3D Displays"	SID
2/23/2015	Jean-luc Doumont	Principiae	"The 3 Laws of Communication"	OSA SPIE IEEE-PS
3/06/2015	Ling Wang	Kent State University	"Near Infrared-light Directing Chiral Liquid Crystal Superstructures: From 1D to 3D"	SID
3/16/2015	Gregory Eskridge	Teledyne Oil and Gas	"Optical Connectivity Solutions for Sub-Sea Systems"	SOS
3/17/2015	Dan Marom	Hebrew University	"Switching technologies for spatially and spectrally flexible optical networks"	IEEE-PS
4/24/2015	Kathleen Richardson	University of Central Florida	"Living the interdisciplinary dream – in a discipline-specific world"	SPIE
5/6/2015	Jennifer K. Barton	University of Arizona	CREOL Distinguished Seminar Series: "Endoscopes for optical coherence imaging and fluorescence spectroscopy: design and applications to cancer imaging"	WiLO
5/27/2015	Jiun-Haw Lee	National Taiwan University	"Improving Solar Cell Efficiency beyond Shockley-Quisser Limit by Singlet Fission—Exciton Dynamics in Rubrene and Tetracene Thin Films"	IEEE-PS SID
6/11/2015	M. J. Soileau	University of Central Florida	"A Creole boy goes to CREOL: Many hands make light work"	SPIE
8/11/2015	Michael Bass	University of Central Florida	"The Modern World – We Owe It To Physics"	SPIE
10/23/2015	Michael Bass	University of Central Florida	"Tiny neutral ones – neutrinos"	SPIE
10/28/2015	Igor Volkov	University of Central Florida	"Network & Career Services"	SOS
10/28/2015	Jessica Carter	University of Central Florida	"How to Write the Best Resumes – Improve your LinkedIn Page"	SOS
11/09/2015	Chris A. Mack	University of Texas at Austin	"The End of the Semiconductor Industry as We Know It"	SPIE
11/17/2015	Bahaa Saleh	University of Central Florida	"The Book of Optics: A Millennium Anniversary"	SOS
11/18/2015	Mohammad Umar Piracha	Multicore Photonics	"Journey through an optics career... from academia to industry"	SOS
12/11/2015	Leonid Glebov	University of Central Florida	"Long and Sinuous Way in Optics Research"	SPIE



University of Central Florida
CREOL – The College of Optics & Photonics
4304 Scorpius Street, Orlando, FL 32816-2700
(407) 823-6800
creol.ucf.edu