

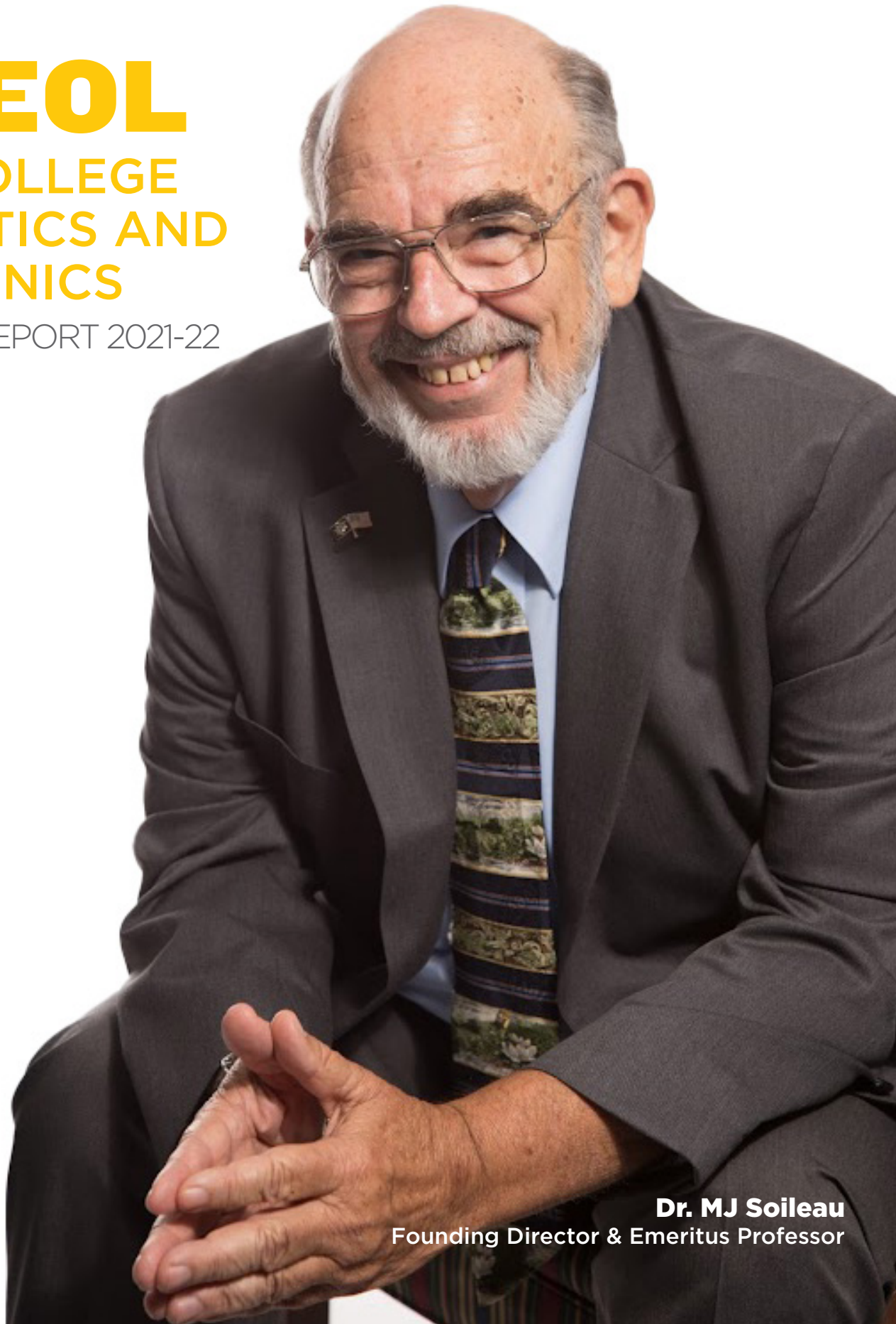


UCF

CREOL

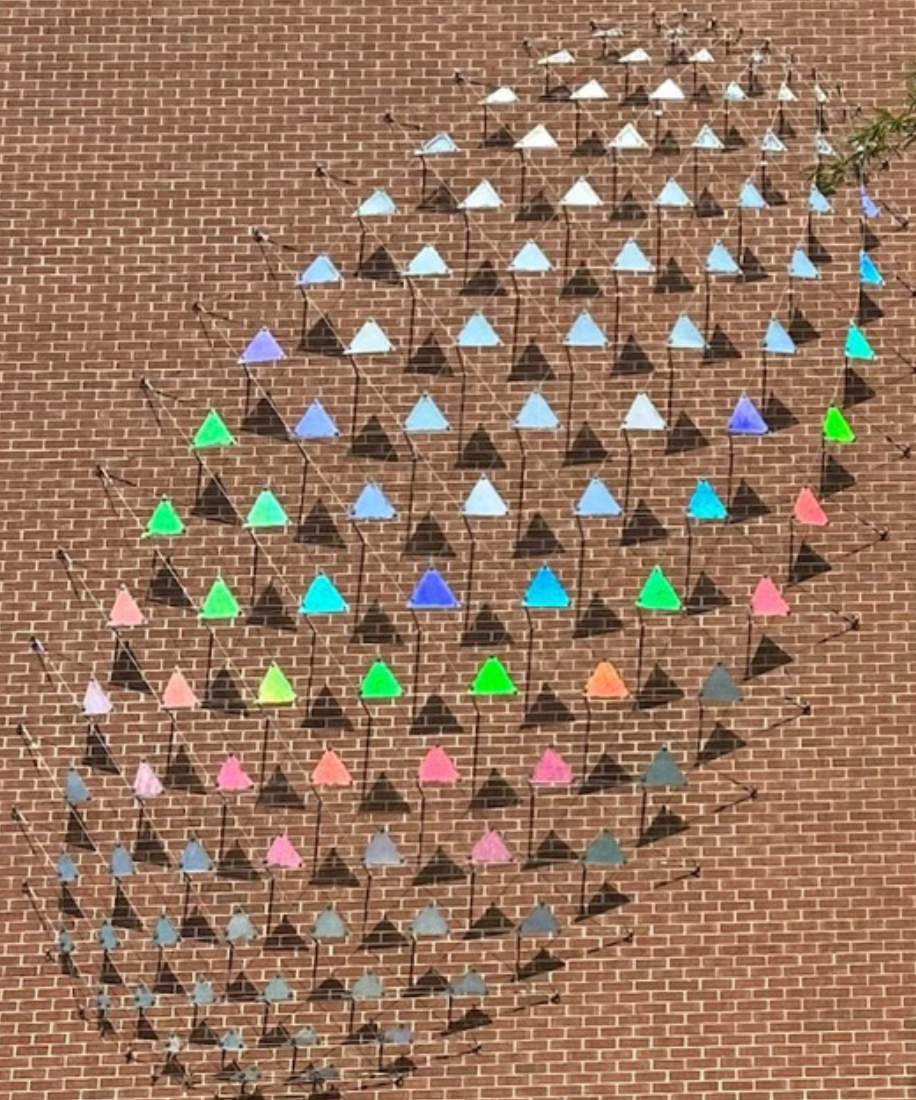
THE COLLEGE OF OPTICS AND PHOTONICS

ANNUAL REPORT 2021-22



Dr. MJ Soileau
Founding Director & Emeritus Professor

CREOL





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LEADING THE CHARGE

2021-22 Executive Committee



Demetrios Christodoulides, Ph.D.

Cobb Family Endowed Chair
Pegasus Professor of Optics & Photonics



Peter Delfyett, Ph.D.

UCF Pegasus Professor of Optics & Photonics and Electrical & Computer Engineering, and Physics
UCF Trustee Chair
Director, Townes Laser Institute



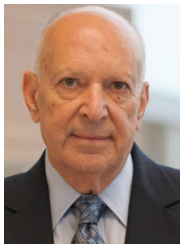
Sasan Fathpour, Ph.D.

Professor of Optics & Photonics and Electrical & Computer Engineering



Patrick LiKamWa, Ph.D.

Associate Dean for Academic Programs
Professor of Optics & Photonics and Electrical & Computer Engineering



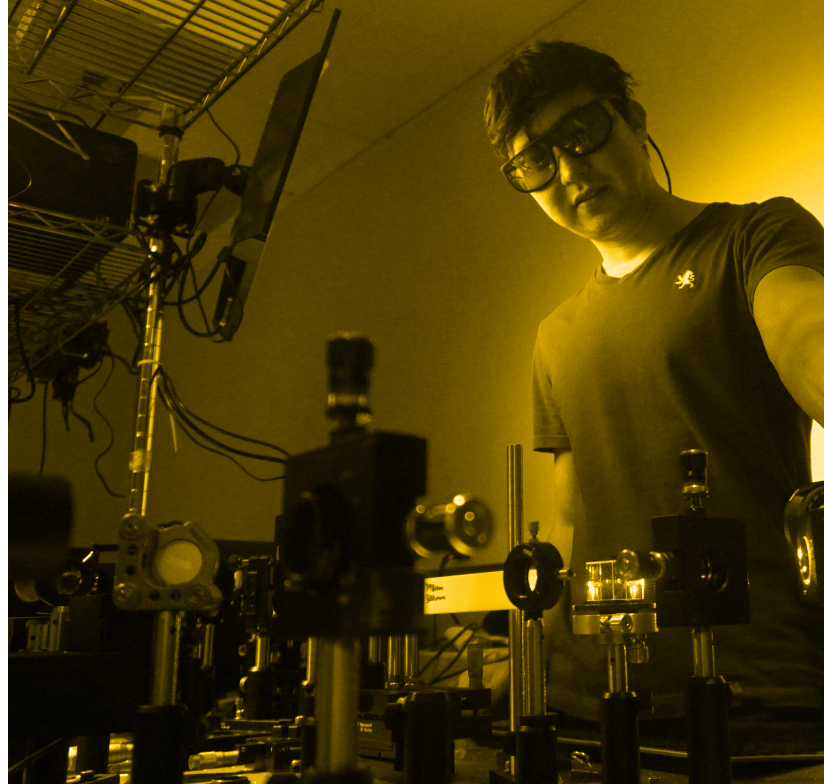
M.G. "Jim" Moharam, Ph.D.

Interim Associate Dean for Academic Programs
Professor of Optics & Photonics



Mark C. Wagenhauser

Finance Director



Dean's External Advisory Council

Council Chair:

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'03MS '05PhD
Lockheed Martin

Jeffrey Crystal '83
Elbit Systems of America

Richard DeSalvo '93PhD
L3Harris

Jihua Du '00PhD
Lumentum

Orges Furxhi
IMEC

Zhibing Ge '04MS '07PhD

Alexei Glebov

OptiGrate Corporation

Carl Kutsche '98PhD

Idaho National Laboratory

Brian Lawrence '97PhD

Gravity Diagnostics

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Chrys Panayiotou '87MS

Indian River State College

Al Symmons

Vital Materials Co. Ltd.

Matt Weed '09MS '13PhD

Luminar Technologies, Inc.

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Austin Brigham '22
Undergraduate Research
Assistant

Lawrence Lipe
Graduate Admissions
Specialist

Benjamin Logan
Undergraduate Research
Assistant

Jessica Peña '19, '22MS
Graduate Research Assistant

Kyle Renshaw
Assistant Professor

Axel Schülzgen
Professor

Zheyuan Zhu '20PhD
Postdoctoral Researcher

A '22 indicates a spring graduate; summer and fall commencement occurs during FY2023



A MESSAGE FROM THE DEAN

Thank you for your support of CREOL, The College of Optics and Photonics. We hope you enjoy looking back on our accomplishments from the past year (July 1, 2021 – June 30, 2022). There was certainly much to celebrate.

CREOL carries a reputation for innovation. Over the years we've developed groundbreaking ideas in optics and photonics here at UCF, and our faculty, students, and alumni are still making incredible advancements in the field.

For example, our Alumna of the Year, **Dr. Félicie Albert '04MS**, Her original plan was to study astronomy, but when she was exposed to laser-specific sciences in CREOL, she shifted her goals. She earned her master's degree from CREOL and went on to earn a doctorate in her home country of France. Her career and industry leadership make her the perfect recipient of this year's award. You can read more about Félicie on page 14.

CREOL faculty also had their fair share of recognition this year. Two were honored as UCF Trustee Chair Professors. The five-year appointment recognizes the national and international reputation of **Dr. Shin-Tson Wu**, and Pegasus Professor **Dr. Kathleen Richardson**. A full list of all our award winners can be found on page 3.

One of our greatest strengths is our industry partnerships. CREOL was founded on the vision of supporting and expanding Florida's optics industry and we continue to build on that goal through our engagement with the members of our Industrial Affiliates program. This mutually beneficial program serves as the conduit between industry professionals and CREOL faculty, students, and researchers. I encourage you to read more on pages 16 and 20.

Finally, I'd like to congratulate my longtime friend and colleague, **Dr. MJ Soileau** on his retirement (page 5). MJ was a big part of the reason I made the move from Texas to Florida to help get CREOL off the ground. Here we are more than 30 years later, and MJ has left very big shoes to fill. Luckily, CREOL has an amazing team to help me, and I was delighted when **Dr. Patrick LiKamWa** was appointed associate dean of academic programs. I know Patrick will help to unleash the full potential of CREOL students and faculty as we improve and grow our graduate and undergraduate programs.

Thank you again for your support, and I look forward to seeing you soon.

A handwritten signature in black ink that reads "David J. Hagan".

David J. Hagan, Ph.D.
Dean & Director
Pegasus Professor of Optics & Photonics

2021-22 Awards

July 1, 2021 - June 30, 2022

EXTERNAL AWARDS

FACULTY

Aravinda Kar

Schawlow Award, LIA
President Elect, LIA

Kathleen Richardson

Distinguished Life Member,
ACerS
Joint Award, ECerS and ACerS

Shin-Tson Wu

Maria Goeppert Mayor Award,
SPIE
Edwin H. Land Medal, Optica

STUDENTS

Ricardo Bustos-Ramirez '18MS '21PhD

Best Student Paper, IEEE
Photonics Conference

He Cheng '19MS '22PhD

Photonics West Best Paper
Award, SPIE

Jianghao (Jasper) Xiong '22PhD

Diamond Award - ILCS-FRL
Outstanding Graduate Student
Award and Scholarship, IEEE
Orlando

Murat Yessenov '19MS '22PhD

Boris P. Stoicheff Memorial
Scholarship, Optica

Kun (Kelly) Yin '19MS '22PhD

Platinum Award - ILCS-FRL
Outstanding Graduate Student
Award and Scholarship, IEEE
Orlando

ALUMNI

Yuge (Esther) Huang '20PhD

Glenn Brown Prize, ILCS

Yi-Hsin Lin '06PhD

SPIE Fellow

Franklyn Quinlan '05MS '08PhD

Optica Fellow

*Note: A '22 indicates a spring graduate;
summer and fall commencement occurs
during FY2023*

UNIVERSITY AWARDS

FACULTY

Ayman Abouraddy

Excellence in Research

Kathleen Richardson

Trustee Chair Professor

MJ Soileau

Emeritus Professor

Shin-Tson Wu

Trustee Chair Professor

STUDENTS

Xuan Lou

Founders' Award

SERVICE TO UCF

Vicky Sue Ortiz Batson '99 '09MA

20 years

Deon Frank

20 years + Retiree

Denise Whiteside

15 years

Nathan Aultman

5 years

Rachel Agerton-Franzetta

Retiree

CREOL AWARDS

FACULTY

Ayman Abouraddy

Excellence in Research

Peter Delfyett

Teaching Incentive Program
Award

Guifang Li

Granted Sabbatical 2022-2023

MJ Soileau

Excellence in Undergraduate
Teaching

Shin-Tson Wu

Excellence in Graduate Teaching
and Research Incentive Award

STUDENTS

Xiaowen (Steven) Hu '20MS

Student of the Year Finalist

Lawrence Trask '21MS

Best Student Poster Award

Murat Yessenov '19MS '22PhD

Student of the Year

Kun (Kelly) Yin '19MS '22PhD

Student of the Year Finalist

ALUMNI

Félicie Albert '04MS

Distinguished Alumna
(see page 14)



New UCF Trustee Chair Professors, Kathleen Richardson (left) and Shin-Tson Wu.



Photo courtesy of SPIE

Popescu Wins SPIE Award Before Tragic Accident

Groundbreaking work in the field of quantitative phase imaging earned **Gabriel Popescu '02PhD** the 2022 Dennis Gabor Award in Diffractive Optics from the International Society for Optics and Photonics (SPIE). Awarded in January, SPIE cited multiple achievements by Popescu as the basis for the win, including his advancements in the technology that studies live cells. His imaging work advanced critical cancer research, including breast cancer detection and label-free tissue scanners for colorectal cancer screening.

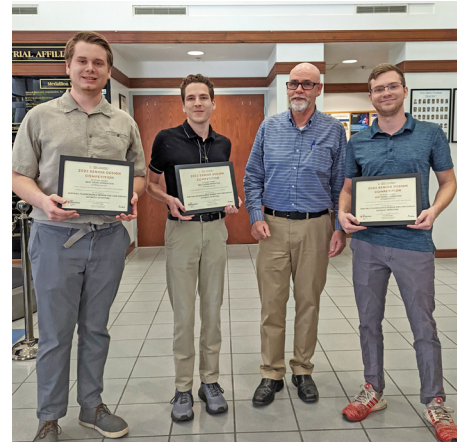
On June 16, Popescu suffered a fatal collision while riding his motorcycle near his hometown of Prundu, Romania.

Popescu taught at the University of Illinois at Urbana-Champaign as the William L. Everitt Distinguished Professor of Electrical and Computer Engineering, where he directed the Quantitative Light Imaging Laboratory at the Beckman Institute for Advanced Science and Technology. He was also the founder and president of Phi Optics, an optical microscopy company developing the next generation of optical imaging systems through its Quantitative Phase Imaging platform.

He earned his doctorate from CREOL under the supervision of **Aristide Dogariu** and was recognized as the CREOL Distinguished Alumnus in 2017.

“To this day, I am still using most of what I learned as a student at CREOL,” he said in a 2021 interview. “I work at a large institution with many brilliant scientists. These colleagues are collaborative, which is something that I was exposed to consistently while a student at UCF and came to value greatly in other scientists.”

Our sincere condolences to Gabi's wife, Catherine Best, his children, Sofia and Sorin, and his mother, Maria.



Winning team of Jevitt, Pearson, Spurgeon, and Morales (not pictured) with Dean Hagan

INAUGURAL SENIOR DESIGN COMPETITION

CREOL hosted a senior design competition - the first of its kind for the college - organized by the student group IEEE Photonics Society and industry sponsor MKS. Undergraduate seniors in the photonic science and engineering degree program presented their projects to a panel of judges from industry and academia.

Congratulations to the Winners



Cristian Pearson '22, Christian Spurgeon '22, Aaron Jevitt, Gean Morales
Portable Fluorescence Sensor for Lyme Disease Antibody Detection



Matt Bowman '22, Nick Pinkham '22, AJ Desantis, Bryce Moon
Automated Laser Cavity Mirror Alignment & Beam Profiler System



Collan Dimitri '22, Jacob Clevenger, Jose Vazquez, Ahmed al Busaidi
Low Power Variable Optic with Automatic Distance Correction



MJ and Cheryl Soileau celebrate his retirement from UCF and CREOL.

FROM FOUNDING DIRECTOR TO EMERITUS PROFESSOR Celebrating MJ Soileau's Retirement

After devoting more than 35 years of his career to UCF, MJ Soileau retired on June 17, 2022. Soileau came from North Texas State University to be the founding director of the Center for Research in Electro-Optics and Lasers (CREOL) in January 1987. He spent the next dozen years transforming the fledgling research center into one of the major educational and research institutions for optics in the world. Thanks to the strong foundation Soileau built, CREOL's designation was upgraded in 2004 to the College of Optics and Photonics – the first of its kind in the United States.

Soileau went on to serve as UCF's vice president for research & commercialization for 17 years spearheading transformational growth in research activities at UCF (see sidebar).

In 2016, Soileau returned to the faculty as distinguished professor of optics, physics, and electrical engineering and resumed his studies of laser-induced damage in optical material. At UCF's Founders Day in April, he was honored with the CREOL Excellence in Undergraduate Teaching award. He now joins the ranks of emeritus professor.



Discussing UCF's new CREOL program at the 1987 Conference on Lasers and Electro-Optics (CLEO).



Celebrating the evolution from center to school in 1998 with VIPs from SPIE and then-Dean Eric Van Stryland.

SOILEAU'S UCF CAREER AT A GLANCE

1987
Founding Director
of CREOL

1998
CREOL becomes
the School of
Optics, Soileau
continues as
Director

1999
Becomes UCF
Vice President
for Research &
Commercialization

SOILEAU'S CAREER HIGHLIGHTS AS VICE PRESIDENT OF RESEARCH & COMMERCIALIZATION

Extramural contracts and grants increased from \$36M in 1999 to over \$145M in 2016

UCF became a national leader in its patent portfolio and its new company incubation plan

The NanoScience Technology Center established

Established the Biomolecular Science Center which grew to become the College of Biomedical Science and eventually merged with the College of Medicine at the Burnett School of Biomedical Science

Reorganized and greatly expanded the Florida Space Institute

Recruited new leadership for: Florida Solar Energy Center, Institute for Simulation & Training, NanoScience Technology Center, and Florida Space Institute



Read more from Soileau in this 2013 *Pegasus* article.

“I took the job because of the opportunity to build an academic unit devoted to optics, to staff it with top scholars in the field of optics, and to attract excellent students. The simple idea was to build an academic unit that would be much better than I could ever be hired into, and then to become a member of it by the historical accident of being present at its birth!”



CREOL faculty and staff gifted Soileau a bicycle for his retirement.



Soileau was honored as a Florida Icon by *Florida Trend* magazine in 2016. Scan/click to read more.

2004

School of Optics becomes CREOL, The College of Optics and Photonics

2016

Distinguished Professor of Optics, Physics, and Electrical Engineering

2022

Emeritus Professor

Alumnus Converts Research, Lab Experience into Faculty Position



The life-long journey to full-time faculty member began for **Josh Kaufman '14PhD** when he was a self-described “nerdy kid” reading engineering magazines. “To rewind the clock to that time, to now being offered a position on the faculty is incredible,” said Kaufman.

Kaufman arrived at UCF in 2008 after studying electrical engineering at Purdue University. That laid the foundation for his work at UCF studying fiber structures to produce micro and nanoparticles for nonlinear optical applications such as ultrafast switches, optical computers, and processing.

“Getting my own lab feels like the next natural step because my research has diverged from where I once started,” said Kaufman. “I began on one end of the optics spectrum and am now embracing the material sciences side of my research.”

After earning his degree and taking on the challenge of becoming an assistant in **Ayman Abouraddy’s** lab for the last thirteen years, Kaufman reflects on what it’s like to accomplish the dreams he once had as a child.

“I’m proud to have gotten to this point in my career,” said Kaufman. “It’s been a lot of work, but the payoff is worth it.”



Retired Army Officer Pursuing Ph.D.

Retired Army officer **Robert Grimming** is using his unique experience with the military to improve the future of military combat vehicles. A full-time CREOL graduate student, he earned his degree in electrical engineering from West Point Military Academy.

Grimming served in multiple positions in the Army, including logistics, explosive ordnance disposal and nuclear operations. One of his proudest moments was becoming an assistant professor at West Point, where he taught for three years.

“It was an honor working with such a diverse group of students motivated to excel in every aspect of their lives and contribute to their nation,” said Grimming.

Upon retiring, Grimming began teaching at Wekiva High School’s magnet program for laser photonics. He left teaching to pursue his doctorate, focusing on infrared imaging systems that will be directly applied to military optics. This includes developing LIWR applications for autonomous vehicle navigation used to advance military vehicle technology.

Being a part of both the Knight Vision lab and the Electro-Optical Infrared Systems group at CREOL reminds Grimming that science is something that can inspire anyone.

“People think that the math and sciences are challenging because it isn’t something that we use every day,” said Grimming. “But being a part of CREOL reminds me of why I enjoy it so much.”



Leonid and Larissa Glebov attend the IYOG conference in Switzerland where he was a featured speaker.

Glebov, Richardson Help Recognize the United Nations International Year of Glass

A high-profile global conference celebrating the United Nations International Year of Glass (IYOG) included two professors from CREOL as featured speakers. February's two-day conference in Geneva, Switzerland, included 30 speakers representing 90 countries. The presentations have been viewed more than 7,000 times worldwide.

The IYOG designation recognizes the pivotal role glass has played across centuries and cultures, from ancient Egyptian art to the silica glass in the fiber optic cables that channel the Internet today. The United Nations designated 2022 the IYOG through the petition of a team that included CREOL Pegasus Professor **Kathleen Richardson** who also virtually delivered a conference presentation "Seeing and Sensing the Future: Enabled by Infrared Glass Innovation." Her remarks encompassed the historical development of infrared glass and its potential to address some of the United Nations 2030 Sustainable Development Goals (SDGs) in quality education, gender equality, climate action, and sustainable cities and communities, among others.

"Glass is renewable and has so many potential applications to address things like climate change," said Richardson. "My talk focused on illustrating the history of glass, and its potential for the future. It is a good way to get the

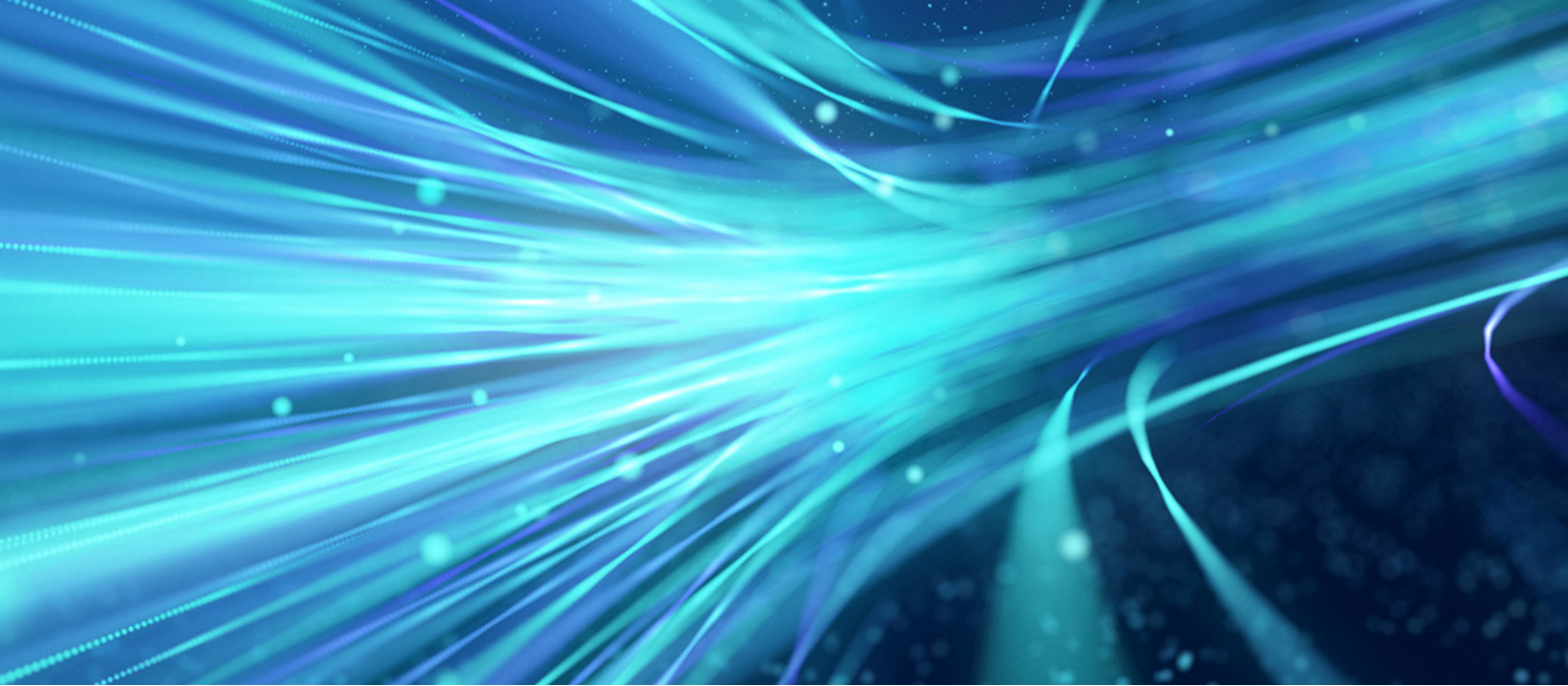
international community thinking about ways we can collaborate to solve some of these big problems."

Glass science was just a portion of the topics discussed. Other speakers shared insights from areas including industry, medicine, academia, the media, museums, and art.

Also representing CREOL was research professor **Leonid Glebov**, who traveled to Geneva to deliver his presentation "Photo-Thermo-Refractive Glasses for Laser Applications." Some of those laser applications include creating holograms that can map the Earth's surface within 20 centimeters and increasingly precise cataract surgery.

"It's significant from my viewpoint that CREOL had two representatives at this conference," said Glebov. "When we were a young center, I had to do a lot of explaining. Now you say CREOL and everyone knows what that is."





Researchers Create Photonic Materials for Powerful, Efficient, Light-based Computing

CREOL researchers are developing new photonic materials that could one day help enable low-power, ultra-fast, light-based computing and lead to quantum computing. The unique materials, known as topological insulators, are like wires that have been turned inside out, where the current runs along the outside and the interior is insulated. They could be used in circuit designs that allow for more processing power to be crammed into a single space without generating heat, thus avoiding the overheating problem today's smaller and smaller circuits face.

In their latest work, published in the journal *Nature Materials*, the researchers demonstrated a new approach to creating the materials using a novel, chained, honeycomb lattice design which they laser etched onto a sample of silica, the material commonly used to make photonic circuits. Nodes in the design allow the researchers to modulate the current without bending or stretching the photonic wires, an essential feature needed for controlling the flow of light and thus information in a circuit.

The researchers envision the new design approach, introduced by the bimorphic topological insulators, will lead to a departure from traditional modulation techniques, bringing the technology of light-based

computing one step closer to reality. Topological insulators could also one day lead to quantum computing as their features could be used to protect and harness fragile quantum information bits, thus allowing processing power hundreds of millions of times faster than today's conventional computers.

The researchers confirmed their findings using advanced imaging techniques and numerical simulations.

"Bimorphic topological insulators introduce a new paradigm shift in the design of photonic circuitry by enabling secure transport of light packets with minimal losses," said **Georgios Pyrialakos**, a CREOL postdoctoral researcher and the study's lead author.

According to the study co-author and CREOL professor **Demetrios Christodoulides**, the next steps for the research include the incorporation of nonlinear materials into the lattice that could enable the active control of topological regions, thus creating custom pathways for light packets.

UCF Awarded \$4.5 Million to Develop Non-GPS Navigation System

The Army Research Lab (ARL) awarded UCF a \$4.5 million grant to develop a smart, computer vision-based navigation system that can be used when GPS is unavailable or jammed. The system will act as a cyber co-pilot that supports navigation of ground vehicles by using artificial intelligence and machine learning to assess computer imaging of complex terrain captured by the vehicle and by unmanned aerial vehicles (UAVs).

“For the Army, this is all about navigating in GPS denied environments wherein adversaries can jam or spoof GPS signals,” said **Kyle Renshaw**, the project’s principal investigator and a CREOL assistant professor.

The system will use geospatial databases to identify landmarks for correlation to imagery and will track object movements through video to estimate motion. Renshaw says although positioning by triangulation and relative motion are not new concepts, the researchers are using artificial intelligence to do this precisely and autonomously.

The cross disciplinary project also includes professors from UCF’s Department of Computer Science and Center for Research in Computer Vision, as well as **Robert Crabbs**, a CREOL senior research scientist. The team is partnering with researchers from the University of Arizona and the University of Memphis.

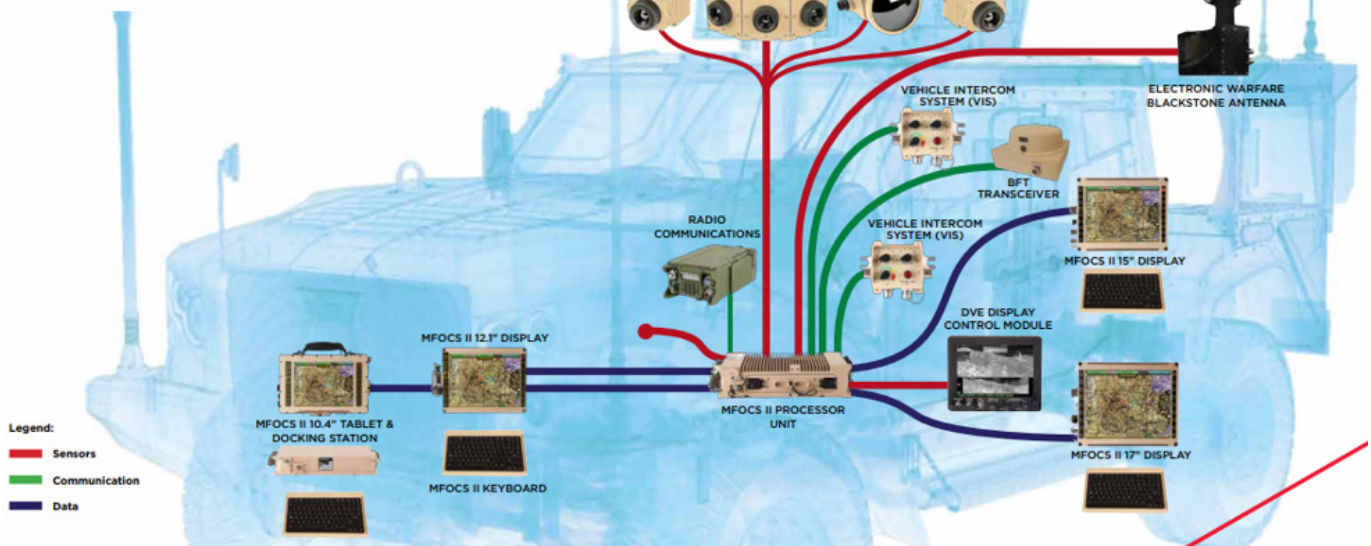
“I’m looking forward to working with ARL and the world-class team we’ve pulled together to address some real, significant and immediate problems for the Army,” said Renshaw. “The technologies and solutions we’re working on have other applications such as border security, disaster response, and autonomous driving.”



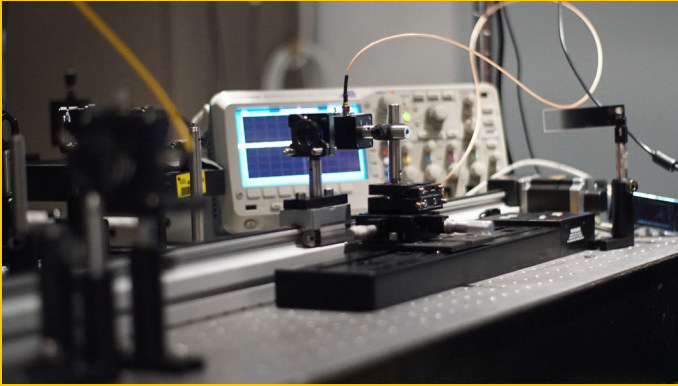
Top: Vehicle testbed
Bottom: Illustrating the concept of a smart, computer vision-based navigation system using multi-sensor inputs and geospatial databases to determine vehicle position.

MFOCS II DOES THAT

MFoCS II is the core component of the Mounted Computing Environment. As the key enabler of any vehicle CSISR architecture, MFoCS II provides a fully integrated Mission Command suite of capabilities. A mission critical tactical server manages communications, sensors, embedded diagnostics, and applications through a single pane of glass. MFoCS II is empowering modernization, converging today and tomorrow.



First Keck Foundation Grant Totals \$1M for UCF



Part of the Keck Foundation grant was used to purchase equipment needed to advance research.

One of the nation's largest philanthropic organizations – the W.M. Keck Foundation – awarded UCF a \$1 million science and engineering research grant. The grant will be used to fund a project led by CREOL professors **Ayman Abouraddy** and **Demetrios Christodoulides** titled “space-time optics for novel light-matter interactions.” This project builds on their previous work developing so-called ‘space-time wave packets.’ These are pulsed laser beams with unique properties that stem from their structure

in space and time. The researchers will exploit these new laser pulses to accelerate tiny particles, known as dielectric particles, that have not been accelerated before. Having this control over small dielectric particles could open new avenues for medicine and for materials and space sciences, the researchers say. These potential applications include using high-speed micro-particle collisions for medical therapy, better understanding how micro-sized space debris adversely affects space vehicles, and informing the use of solar sail propulsion for small-scale space probes.

This is UCF's first Keck grant. William Myron Keck, the founder of the Superior Oil Company, established the Keck Foundation in 1954 which is now one of the nation's largest philanthropic organizations with more than \$1 billion in assets. The foundation invests in pioneering discoveries in science, engineering, and medical research that lead to breakthroughs and new technologies to save lives, offer innovative solutions, and add to the understanding of life and of the universe.

Graduate Students Awarded DEPS Grants, More Than Any Other University

The Directed Energy Professional Society (DEPS) awarded two CREOL graduate students research grants to continue their work in the area of directed energy.

Jessica Peña '19MS '22PhD and **Owen Thome** are part of the Laser Plasma Laboratory, which is part of UCF's Center for Directed Energy. Also recognized was College of Engineering and Computer Science student, **Nicholas Vail**.

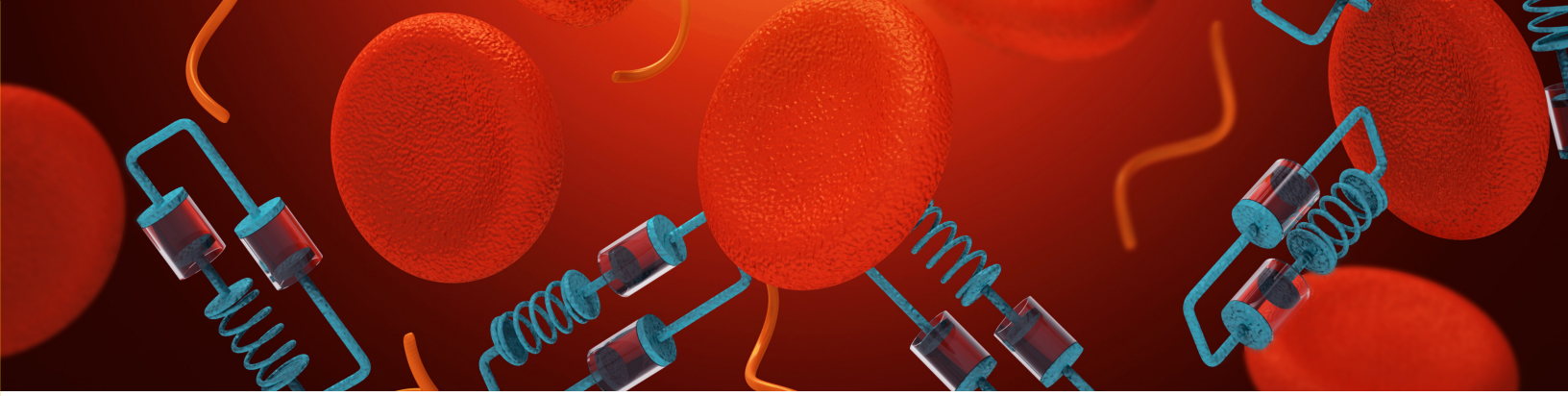
Peña was named the Dr. Samuel Blankenship Directed Energy Scholar award winner. A second-time grant recipient, she was awarded support for her work on laser light filament propagation at high altitude.

Thome received an award for his work on a new ultrafast long-wavelength infrared (LWIR) laser development. This novel type of a high-power

laser system will be tested for the first time anywhere at UCF's Townes Institute Science & Technology Experimentation Facility according to photonics professor **Martin Richardson**, who leads the Laser Plasma Lab and the Center for Directed Energy at UCF.

DEPS provides grants to students who are conducting promising research in directed energy technology, high-power laser development, high-power microwaves, and ultrashort pulse lasers.

“DEPS recognizes our students' caliber and ingenuity, which is why it has given so many UCF students scholarships over the past decade — more than any other university,” said Richardson, who was named a DEPS Fellow in 2021.



Real-time Blood Monitor Saves Doctors Critical Time During Surgery

An innovative device developed by researchers at CREOL and Orlando Health can save doctors critical time during life-or-death operations, like heart surgery. The real-time monitor provides instant blood analysis to let surgeons know if a deadly problem in many surgeries, blood coagulation, is happening.

Currently, to determine if a heart surgery patient's blood is thin enough to avoid forming clots in a heart-lung machine, blood must be drawn throughout the procedure and sent to a lab for testing.

"There are two problems there," said study co-author **William DeCampi**, a pediatric cardiac surgeon at Orlando Health Arnold Palmer Hospital for Children and professor of surgery in UCF's College of Medicine. "One, we're drawing blood from a patient periodically, and if this patient is a newborn baby, it doesn't take much blood drawn to cause the baby to have a problem with blood loss. Secondly, when we send these tests away, it takes time to get the answer back, as much as 20 or 30 minutes. And that's too long."

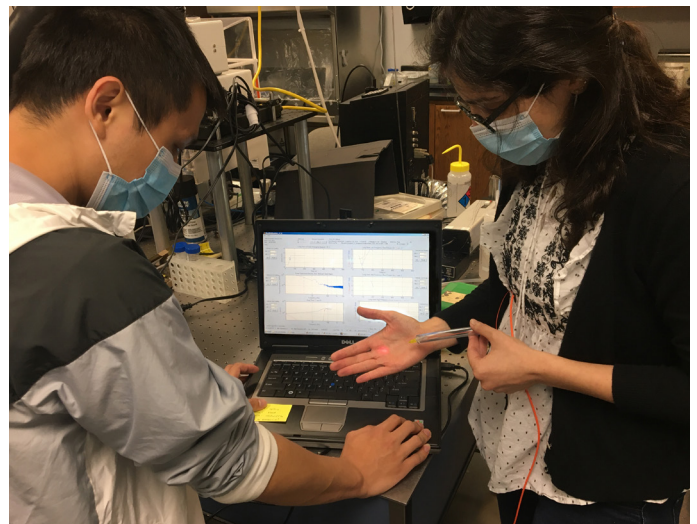
DeCampi has been working with CREOL Pegasus Professor **Aristide Dogariu** since 2017 to develop the blood monitor. Their research is funded by the U.S. National Institutes of Health.

The collaboration developed after DeCampi learned of Dogariu's work using light scattering from a laser to measure the thickness of various fluids and mixtures. The monitor uses an extremely small optical fiber that's a fraction of a millimeter in diameter to assess the status of the blood and can be inserted directly into the tubes

of a heart-lung machine or in a catheter, without having to draw blood from the patient.

The optics-based blood monitor has moved through in-lab testing and then a successful clinical trial, the results of which were published in *Nature Biomedical Engineering*. With continued success and funding, the researchers hope to see the blood monitor become available within the next five to seven years.

Study co-authors also included **Jose Rafael Guzman-Sepulveda '16MS '19PhD**, a researcher with the Center for Research and Advanced Studies of the National Polytechnic Institute in Mexico, and CREOL graduate research assistants, **Mahed Batarseh '20MS '22PhD** and **Ruitao Wu '21MS '22PhD**.



Graduate research assistants Ruitao Wu and Mahed Batarseh demonstrate the UCF-developed optical blood monitor.

Above: The researchers' model of red blood cells. Image credit: Jose Rafael Guzman-Sepulveda

Alumna is Witness to Laser Technology Evolution



Edesly Canto-Said '89PhD has been watching the evolution of laser technology since the 1980s, when she was one of the first group of students to attend the newly formed Center for Research in Electro-Optics and Lasers (CREOL) at UCF. More than three decades later, Canto-Said is now serving as the chief technology officer (CTO) of laser-based solutions company Clark-MXR, Inc.

“It’s hard to believe how far laser technology has come since the 1980s,” said Canto-Said. “When I first began studying laser applications, we knew as scientists that they had the potential to solve many real-world problems. Now we actually see those applications on a day-to-day basis.”

A large part of Canto-Said’s duties as CTO includes overseeing the prototyping and manufacturing of industrial parts using ultrafast lasers, as well as producing lasers for scientific instrumentation. The inspiration behind much of the work being done at Clark-MXR is offering creative solutions to real-world problems. This is the force that drives Canto-Said out of bed and into the lab every day.

“It is exciting to see how much we can do with lasers,” said Canto-Said. “We solve problems found in many different fields, whether it is medical, mechanical or electronics — just to name a few.”

Time spent earning a CREOL degree helped shape Canto-Said into the scientist, and person, she is today. “I made many long-lasting friendships as CREOL grew from just a handful of us to many more,” she said. “On top of that, not a day goes by where I’m not applying something from my degree. I have felt very prepared throughout my career.”

Looking back on her time as a student, Canto-Said has advice for those looking to pursue a career as an optical scientist. “At CREOL I had excellent mentors and I wish I picked their brains more often,” she said. “Worry less about what lies ahead and more about absorbing the knowledge that surrounds you.”



Left: CREOL circa 1989 from L to R: Canto-Said, Brigitte and Johanna Guenther, Ali Said, Eric Van Stryland, David Hagan, Wendy Wu, Mansoor Sheik-Bahae.

Right: Canto-Said with MJ Soilleau at his 2022 retirement reception.



CREOL Dean David Hagan presents Félicie Albert '04MS with her Alumna of the Year award

CREOL Inspired New Trajectory for Distinguished Alumna

Embracing change has yielded multiple rewards for **Félicie Albert '04MS** including a new title as CREOL 2022 Distinguished Alumna of the Year.

One of the French-born physicist's first opportunities to embrace change took place at the Ecole Centrale de Marseille of Marseille, France, where she was finishing undergraduate studies. An exchange program offered a big change - the chance to study in the U.S. with some of the finest optics professors.

"I struggled with school when I first arrived at UCF (in 2002)," said Albert. "I couldn't speak English very well and all of my classes were in this brand-new language. Regardless, I was still enamored with the course material. My professors inspired me deeply from the very start."

Albert's original intent was to study and research astronomy. Her exposure to laser-specific sciences in CREOL shifted her goals entirely as she embraced the change.

"Building lasers is hands-on and very rewarding," said Albert. "Learning about what these lasers could then be applied to after the building process is what really got me hooked in the field."

After graduating from UCF with her master's degree in optics, Albert returned home with her newfound passion for lasers. She hasn't spent an

idle moment since graduating with a doctorate from Ecole Polytechnique.

Now serving as the deputy director for the Center for High Energy Density Sciences and Jupiter Laser Facility at the Lawrence Livermore National Laboratory in California, Albert recollects just how fruitful her career has been.

"I've been with Livermore for the last fourteen years and have loved every moment of it," said Albert. "Every day looks different and brings with it unique problems to solve. It's a challenging and rewarding place to be a part of."

Albert has received the Katherine E. Weimer Award from the American Physical Society, a Presidential Early Career Award for Scientists and Engineers (PECASE) and was recently named a fellow after a nomination from the APS Division of Plasma Physics. She is also the current chair of LaserNetUS, a network of high intensity laser facilities across America, of which UCF recently became a member.

"It is a true honor to receive this (Distinguished Alumna) title," said Albert. "This is the place where everything truly started for me, so it is nice to see it come full circle."



CREOL Dean David Hagan and ficonTEC CEO Torsten Vahrenkamp

International Optics Leader Opens Application Lab in CREOL, Joins UCF Business Incubation Program

A unique new academic-industrial alliance between UCF and ficonTEC, a global leader in photonics manufacturing, is expected to bring a boost to the region and provide access to sophisticated industry production tools for students and faculty researchers. It also paves the way for students to take their prototypes from theoretical to literal and opens doors for regional industry growth.

FiconTEC, a German-based company with locations in Europe and the Far East, is expanding to Central Florida — joining UCF’s Business Incubation Program as a Soft Landing client and opening an applications lab at CREOL. The new lab will serve as a research and development manufacturing facility for ficonTEC, and will also be open to UCF students, faculty, and local industry partners.

Torsten Vahrenkamp, ficonTEC’s CEO, says the move started as an answer to interrupted global supply chains and growing demand for their products, in particular in North America where there is greater adoption of integrated photonics. The partnership with CREOL offers the added benefit of teaming up ficonTEC systems and engineers with faculty experts and leaders in the field.

“We could not have hoped for a better environment from which to re-launch our USA activities,” said Vahrenkamp.

CREOL students and faculty regularly produce prototypes and theoretical devices but are limited in their ability to create a functional model. FiconTEC’s application lab will bring the precise, advanced equipment needed to fabricate the finished prototypes that attract investors.

“This partnership brings a new dimension to CREOL’s established photonics R&D groups and in the United States as a whole,” said CREOL Dean, **David Hagan**. “It provides UCF students an unmatched opportunity to learn the techniques of photonics integration.”

FiconTEC is the fourth company to join UCF’s photonics incubator within CREOL, and the first and only to offer its own manufacturing capabilities. The incubator is also home to LC Matter Corporation, Plasmonics and Olkin Optics. Companies in the Incubator may use CREOL laboratory facilities, benefit from collaborations with faculty and graduate students, and access UCF’s business development resources.

Industry Partners Share Research, Advancements at Annual Symposium

A preview of the future in optics was shared over two days in April at the CREOL Industrial Affiliates Symposium. Top talent from around the globe gathered to explore and discuss topics including augmented and virtual reality, liquid crystal optical elements, and highlights of the latest glass research.

UCF President **Alexander Cartwright**, an internationally recognized researcher and scholar in the area of optical sensors, participated in the Symposium. Among the featured topics was a deeper look into the development of the James Webb Space Telescope, presented by Chief Mission Architect, **Jon Arenberg**, from Northrop Grumman. The Optimax Research Grant was awarded to CREOL professor **Stephen Eikenberry** for his proposal to create an OPASpec instrument.

“It was great to be reunited with old colleagues and make new friends,” said CREOL Dean, **David Hagan**. “This event offered a lot of optimism and encouragement around the growth of our field, and the success of CREOL.”

The annual Symposium brings together members of the CREOL Industrial Affiliates (IA) program which serves as a conduit between the college and industry professionals. IA members enjoy access to CREOL faculty, students and researchers while supporting the college through their membership dues.

“Our laboratories on campus are home to amazing developments in optics and photonics, but we’re just one piece of a much bigger community,” said Hagan. “Networking and learning from our Industrial Affiliates highlights the richness of that community.”

2022 INDUSTRIAL AFFILIATES SYMPOSIUM PRESENTERS:

- | | |
|------------------------------------|-----------------------------------|
| BEAM Co. | Florida Photonics Cluster |
| U.S. Air Force Research Laboratory | Gentec-EO |
| Northrop Grumman | Critical Frequency Design |
| Meta Reality Labs | CMS Laser (Control Micro Systems) |
| OPTICA | ficonTEC |
| SPIE | |



Top: Jon Arenberg, Chief Engineer for Space Science Missions at Northrop Grumman, presents the latest information about NASA's James Webb Space Telescope.

Middle: Barry Silverstein from Facebook (now Meta) Reality Labs shared how AR and VR display will change the world of optics.

Bottom: Stephen Eikenberry (right) accepts the OptiMax Research Grant from Optimax's Director of Technology, Jessica DeGroot Nelson. On the left are Genevieve Markees and Christina Moraitis from Eikenberry's research group.

Doctoral Dissertations and Post-Graduation Employment

Optics & Photonics Ph.D.



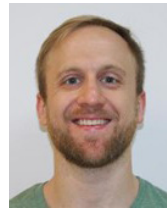
Kamal Mohamed Khalil Abdelsalam '18MS '21PhD

Dissertation: "Integrated thin-film lithium niobate devices and circuits for nonlinear- and quantum-optic applications"

Advisor: Sasan Fathpour

Employer: Keysight Labs

Title: Integrated Photonics Researcher



Heath Gemar '21PhD

Dissertation: "Spectral Dependence of Deep Subwavelength Metallic Apertures in the Mid-Wave Infrared"

Advisor: Kyle Renshaw

Employer: US Naval Research Laboratory

Title: Research Physicist



Mahed Batarseh '20MS '22PhD

Dissertation: "On the Passive Sensing of Static and Dynamic Properties of Secondary Sources"

Advisor: Aristide Dogariu

Employer: Intel Corporation



A F M Saniul Haq '21PhD

Dissertation: "Directional Link Management Using In-Band Full-Duplex Free-Space Optical Transceivers for Aerial Nodes"

Advisor: Murat Yuksel

Employer: Intel Corporation

Title: TD Process Engineer



He Cheng '19MS '22PhD

Dissertation: "Volumetric Microfabrication With Structured Light"

Advisor: Xiaoming Yu

Employer: Intel Corporation

Title: Yield Engineer



Isa Hatipoglu '19MS '21PhD

Dissertation Title: "Ultraviolet Solar-blind Ga₂O₃-based Photodetectors"

Advisor: Winston Schoenfeld

Title: Assistant Professor, Electrical and Electronics Engineering Department

Employer: Sirkak University



Justin Cook '17MS '21PhD

Dissertation: "High Power Ytterbium and Thulium Fiber Lasers"

Advisor: Martin Richardson

Employer: UCF CREOL

Title: Research Scientist



Mohammad Jobayer Hossain '20MS '21PhD

Dissertation: "Measurement and Mitigation of Optical, Recombination and Resistive Losses in Silicon Photovoltaics"

Advisor: Kristopher Davis

Employer: AIM Photonics

Title: Electronic-Photonic Engineer



Benjamin Croop '19MS '21PhD

Dissertation: "Development of Quantitative Intensity-Based Single-Molecule Assays"

Advisor: Kyu Young Han

Employer: Intel Corporation

Title: Defect Metrology Yield Engineer



Taiki Kawamori '19MS '21PhD

Dissertation: "Nonlinear Light-Matter Interactions in Novel Crystals for Broadband Mid-Infrared Generation"

Advisor: Konstantin Vodopyanov

Employer: Passenger, Inc.

Title: Optical Engineer



Stefan Gausmann '17MS '21PhD

Dissertation: "Specialty optical fibers and their application in fiber laser systems"

Advisor: Axel Schulzgen

Employer: Coherent Inc.

Title: Senior Optical Engineer



Haley Kerrigan '17MS '21PhD

Dissertation: "Long-Range Laser-Material Interactions with High-Intensity Laser Pulses"

Advisor: Martin Richardson

Employer: UCF CREOL

Title: Research Scientist



CREOL STUDENT OF THE YEAR



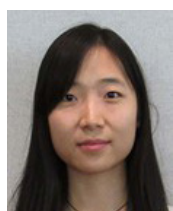
Nafiseh Mohammadian '18MS '22PhD

Dissertation: "Development of Holographic Phase Masks for Wavefront Shaping"

Advisor: Ivan Divliansky

Employer: Google Inc.

Title: Optical Engineer



Jinhan Ren '20MS '21PhD

Dissertation: "Multi-functional fluorescence microscopy via PSF engineering for high-throughput super-resolution imaging"

Advisor: Kyu Young Han

Employer: KLA Corporation

Title: Optical Engineer



Enrique Sanchez Cristobal '20MS '21PhD

Dissertation: "High Spectral Brightness, Broad Area Quantum Cascade Lasers"

Advisor: Arkadiy Lyakh

Employer: IRGLARE, LLC.

Title: Senior Scientist



Zhean Shen '21PhD

Dissertation: "On the Information Content in Unresolved Imaging"

Advisor: Aristide Dogariu

Employer: UCF CREOL

Title: Research Scientist



Mengdi Sun '21MS '22PhD

Dissertation: "Light-trapping transparent electrodes"

Advisor: Pieter Kik

Employer: Virginia Institute of Technology

Title: Research Scientist



Jianghao (Jasper) Xiong '22PhD

Dissertation: "Diffractive Liquid Crystal Optical Elements for Near-eye Displays"

Advisor: Shin-Tson Wu

Employer: Beijing Institute of Technology

Title: Assistant Professor



Murat Yessenov '19MS '22PhD

Dissertation: "Physics and applications of space-time wave packets"

Advisor: Ayman Abouraddy (pictured on left)

Employer: UCF CREOL

Title: Research Scientist



Kun (Kelly) Yin '19MS '22PhD

Dissertation: "Patterned Liquid Crystal Devices for Near-Eye Displays"

Advisor: Shin-Tson Wu

Employer: Amazon Inc.

Title: Optical System Engineer

Electrical Engineering Ph.D.



Joseph Coffaro '21PhD

Dissertation: Exploration of an Alternative Refractive Index Spectrum Model and its Effects on a Laser Beam Propagating Through Random Media

Advisor: Martin Richardson

Employer: Radiance Technologies

Title: Laser Engineer



Pooya Nabavi '20MS '22PhD

Dissertation: "Multi-Element Mobile Optical Wireless Communication Networks"

Advisor: Murat Yuksel

Employer: Apple

Title: Camera Hardware Designer

Physics Ph.D.



Sajad Saghaye-Polkoo '19MS '22PhD

Dissertation: Imaging Based Beam Steering for Optical Communication and Lidar Applications

Advisor: Kyle Renshaw

Employer: Intel Corporation

Title: Defect and Metrology Engineer

FAST FACTS 2021-2022

Rankings



U.S. News and World Report

- #20** Best Global Universities for Optics
- #3** Best U.S. Universities for Optics*
- #5** Best Graduate Degree in Atomic/Molecular/Optical Physics*
- #8** Most Innovative Universities*

*Among public universities in the U.S.

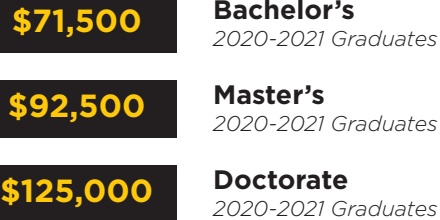
Top Alumni Employers

- Amazon
- Apple
- Google
- Intel
- L3Harris
- Lockheed Martin
- Meta
- Microsoft
- Northrop Grumman
- Academia (Postdoctoral Research)
- National Research Labs

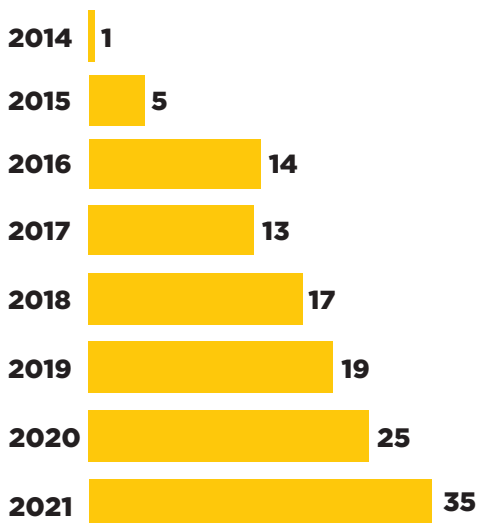
Degrees Awarded



Median Starting Salaries



PSE Degrees per Year*



*Bachelor of Science in Photonic Science and Engineering

Top 2% Global Optics Experts

44% of CREOL faculty were recognized by the journal *PLOS Biology* as being among the world's top scholars

Faculty with Ph.D.s

 **100%**

Patents & Publishing

204 Publications*

14 Patents Awarded

**Refereed Journal Publications*

Top Published Faculty

- Shin-Tson Wu
- Rodrigo Amezcua-Correa
- Kathleen Richardson
- Martin Richardson
- Stephen Eikenberry

Research Funding

 **19.4M**
FY22

Top Funded Principal Investigators



- Kyle Renshaw (pictured)
- Ayman Abouraddy
- Demetrios Christodoulides
- Felix Tan '14MS '19PhD
- Robert Crabbs

INDUSTRIAL AFFILIATES

Membership in the CREOL Industrial Affiliates (IA) program provides corporations, organizations, and individuals networking and collaboration opportunities with our research faculty and students as well as other IA members. In addition, IA members can readily connect with optics, photonics, and industrial organizations in which CREOL maintains active participation and leadership roles.

LIFE MEMBERS

Cobb Family Foundation
Northrop Grumman Corp.
Nufern

MEMORIAL MEMBERS

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

MEDALLION MEMBERS

Breault Research
IPG Photonics
MKS (Newport, Ophir,
Spectra-Physics)

Northrop Grumman
Laser Systems
II-VI Aerospace & Defense
Synopsis
Paul G. Suchoski, Jr.

SENIOR MEMBERS

AFL
ASML US
BAE Systems
CST of America
EXFO Optical Products*
Facebook Reality Labs
FARO Technologies
Google*

LAS-CAD GmbH
Lockheed Martin
LUMENTUM*
Optimax Systems Inc.
Optronic Laboratories Inc.
Tektronix
Zemax
Zygo Corporation

AFFILIATE MEMBERS

Analog Modules
Andor Technology
Appicote Associates LLC
Asphericon Inc.
Avo Photonics
BEAM Co.
Coherent Inc.
CMS Laser (formerly
Control Micro Systems)
DataRay Inc.
Edmund Optics
Elbit Systems of America
eVision LLC
Finetech
Gentec-EO
L3Harris Corporation
HORIBA Jobin Yvon Inc.
J.A. Wollham Co.
JENOPTIK Optical
Systems Inc.
KBR
Laser Institute of America
LG Electronics

LGS Innovations
LightPath Technologies
Luminar Technologies Inc.
Menlo Systems
NKT Photonics Inc.
nLight
Ocean Insight
OPTICA
Optigrate
OptoSigma Corporation
Plasma-Therm
Plasmonics
Q-Peak Inc.
Raytheon Technologies
ScannerMax
International Society for
Optics & Photonics (SPIE)
Thorlabs
TwinStar Optics
ULVAC Technologies Inc.
Vescent Photonics
Yokogawa

**New Members*



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

UNIVERSITY OF CENTRAL FLORIDA

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