New Nanophotonics Faculty Member: Stephen M. Kuebler

by Eric Van Stryland

The School of Optics continues to grow! We welcome this year yet another addition to the faculty, Dr. Stephen M. Kuebler. Steve joined the School of Optics on 8 August 2003 as an Assistant Professor through a joint appointment agreement with the UCF Department of Chemistry. Before coming to UCF, he worked at Caltech and the University of Arizona with Professors Joseph Perry and Seth Marder as a post-doctoral researcher and later as a Staff Scientist on the development and application of two-photon absorbing materials. His research activities included the design and characterization of two-photon initiators for 3D information storage and 3D microfabrication (3DM); 3DM of microfluidics for single-

New nano facility

The Leica EBPG5000+ system at the School of Optics/CREOL is capable of running at 20, 50 and 100 kV, with a minimum spot size of less than 10nm. Write times are much faster than previous tools thanks to a 25MHz intelligent pattern processor. There are fewer than 20 of these tools in the world, making it truly a unique piece of equipment.
Let me start this column by directing your attention to the results of an independent assessment of the value of the research carried out here at School of Optics: CREOL (The FPCE is still too young to have been part of this – but soon). Please take a look at http://esi-topics.com/optoelectronics/index.html. Citation index services officially tabulate data such as the number of times a research article is valuable enough to be cited in reference by other researchers. If you look at this site under top papers you’ll see that we have the #2 and # 20 top cited papers in the world between 1991 and 1999, and this includes ALL optoelectronics journals. Under top cited authors during this period three of our faculty members are in the top 25 and these same three are also tops in citations per paper which is another estimate of overall quality. Under top cited institutions UCF is #7 in the world; however, if you look just at universities, we are #3 behind Stanford and MIT where multiple departments publish in optoelectronics. And we only started around 1987! Importantly this index only goes up to 1999 and we have grown a great deal since that time! It can only get better.

A list of our new FPCE Industrial Advisory Board (IAB) members is included in this issue of HighLights. On September 26 we held the first meeting of the FPCE IAB here in the CREOL building. The IAB elected a chairperson from their ranks, Dr. Douglas Stanley of Northrop Grummann Laser Systems (formerly Litton Lasers). We reviewed and revised the call for proposals and it can be found at http://www.research.ucf.edu/sponsoredresearch/internalprog/fpce.htm. This site will give you details on the evaluation criteria as well as information on the FPCE itself. This call was disseminated throughout the State of Florida to University researchers. Strong Florida industrial collaboration is encouraged. The due date for the first round of proposals is Feb 1, 2004, with awards announced mid March.

On the same day as the IAB meeting we also held a “bidders conference” to which faculty members across Florida were invited. I explained the call for proposals and procedures and then had the faculty meet informally with the IAB members to help make connections and plan proposals. Twenty two IAB members attended, along with 16 faculty members. We have had several faculty members from other universities in the State come here to make connections with our faculty – so it is working! We are currently in the process of creating the formal Search Committees to set up hiring guidelines and conduct the search for the FPCE chaired professorships.

We had a good representation of School of Optics faculty and students at the National Fiber Optics Engineers Conference, NFOEC (ITcom) meeting held Sept 7-11 at the Orange County Convention Center here in Orlando. Several of our faculty members were involved in a conference panel discussion related to our research here. The panel was followed by a bus ride for a conference “side trip” which we hosted at the request of NFOEC: a tour of CREOL and a reception here in our lobby. This was well-attended and very lively. See http://www.nfoec.com for details. In November we had a much larger event here. We hosted the annual Optics in the SouthEast (OISE) conference here on campus on November 12-13, 2003. It was the first time the School of Optics had hosted a two day regional research conference and by all accounts it was a great success. See the article later in this issue for details.

In the last issue we announced the addition of three faculty members in the nanophotonics area and highlighted one of them (Pieter Kik) in our cover article. In this issue we introduce Dr. Stephen Kuebler, who came to us from the University of Arizona. He is a chemist and has a joint appointment with the School of Optics and the UCF Department of Chemistry. In the next issue look for a feature on another new joint appointment, Dr. Kurt Busch, an expert in photonic crystals, who has just joined us from Karlsruhe University in Germany.

An urgent problem that we are facing here right now is that we have run out of space. The CREOL building is now full. The Nanophotonics Systems Fabrication Facility finalized that! (See below.) One possible solution for the relatively near future is to obtain funding to build an extension onto the CREOL building. We have made initial contacts with the US Economic Development Agency and have written a proposal (about to be submitted) that would provide joint-use space for the School and for Florida photonics companies working to transfer the technology of university-based research to industry. Such space could, for example, be leased by incubating companies who were licensing technology developed by faculty.

Renovation of space in the CREOL building for our Nanophotonics Systems Fabrication Facility (NSFF) is complete, and the Leica 5000+ electron beam lithography system is being installed (a 6 week process!). The system is expected to have a spatial resolution of better than 10 nm – that’s 1 ten-thousandth the width of a human hair! The final cost for NSFF construction was ~$1.8M. This facility has the potential for significantly changing the research capabilities of UCF faculty members as well as local industry. We hope that it will become a sought after facility for both industry and faculty from around the State.

You may notice that we have not printed the list of current publications in this issue. This was a decision based on the costs of publishing and mailing Highlights. Limiting the number of pages saves considerable dollars. We plan to replace this with a list of School of Optics publications on our web site at www.creol.ucf.edu (and www.FPCE.ucf.edu). We solicit comments on this decision.

Finally, I would like to ask our Alumni and others associated with the School of Optics, CREOL or FPCE to please go to our website and update your contact information online - see “Alumni & Associates”. We are working to make this database useful to you. Suggestions are solicited!
FACULTY NEWS

On September 03, Professor Demitri Christodoulides became a Fellow of APS – the American Physical Society. Professor Shin-Tson Wu became a Fellow of the IEEE for his contributions to liquid crystal displays and tunable photonic devices. Professors Jannick Rolland and Aristide Dogariu became Fellows of the Optical Society of America. The official OSA statement for Dr. Rolland was: “You are being recognized for contributions to image quality assessment techniques for medical imaging and for optics in virtual environments.” The statement for Dr. Dogariu was: “You are being recognized for contributions towards the understanding of scattering, coherence and polarization.” Dr. Leon Glebov has recently been made a Fellow of the American Ceramic Society.

Professor Jannick Rolland is also the recent winner of the Excellence in Teaching Award for the UCF School of Optics. Her award will be presented at the upcoming UCF Founders’ Day ceremony.

In the 2002-03 budget, the UCF Board of Trustees supplied funding for up to eight Trustee Chairs to reward existing UCF faculty who have chaired professor credentials and to help attract additional high-quality faculty to UCF. An advisory committee composed of the Pegasus professors and the president of the Faculty Senate set criteria and made recommendations to President Hitt. These chairs have a five-year renewable appointment and an annual stipend of $50,000 with up to 50 percent of the stipend used as a salary supplement. In the last issue we proudly announced that two of our faculty members, Peter Delfyett and Glenn Boreman, were selected for this award and honor: Look for articles later in this issue where we highlight their work.

At the Frontiers in Optics Meeting (formerly Annual meeting of OSA) in Tucson this past November, George Stegeman was presented with the OSA’s Wood Prize. See http://www.osa.org/aboutosa/awards/theawards/recent.asp to learn more.

Kuebler, from cover

molecule information storage; 3DM of switchable diffractive micro-optical devices; and the use of two-photon absorbers for optical limiting in liquid crystal charge-transport media.

At UCF, Steve’s research program will focus on the development of materials and processes for nano- and microfabrication and their use for creating new optical materials and devices. In the area of nanophotonics, his group will develop a fabrication methodology that enables metal nanoparticles and bulk material to be patterned on dielectric surfaces by scanning near-field photolithography. These systems may provide a new route to metal-dielectric composites, or meta-materials, that are predicted to have unusual optical properties, such as a negative refractive index. He is also interested in the use of 3DM for making micro-structures that enhance the optical detection of biological species, such as proteins; and that can be used to direct the growth of tissues onto a target 3D form.

Steve earned a B.S. degree in chemistry and a B.A. degree in German from Tulane University, where he was awarded a Barry Goldwater Fellowship in the physical sciences. He received a Marshall Fellowship and a National Science Foundation Fellowship to pursue graduate research in chemistry at the University of Oxford. There he earned the D.Phil. degree for studies of the third-order nonlinear optical properties of molecular materials by time-resolved degenerate four-wave mixing, under the supervision of Professors Robert Denning and Malcolm Green. He has research experience in materials science, photochemistry, nonlinear spectroscopy, and nonlinear optical materials.

In the Department of Chemistry, Steve is teaching inorganic and materials chemistry courses. He will play a vital role in expanding the expertise in optical materials at the School of Optics and developing the materials curriculum in chemistry to support our new Ph.D. program.

Outside of his scientific interests, Steve plays the clarinet, regularly practices yoga, and enjoys cooking (truly enjoyable synthetic chemistry!). He is also a native of Louisiana, so joining a place named “CREOL” is something of a home-coming for him. Says Steve, “I was attracted to UCF, and the School of Optics in particular, because I sensed a genuine spirit of collegiality and eagerness to collaborate amongst the faculty. Since coming here, I have found that the environment is even better than I expected! I am extremely proud to be part of this world-renowned institution, and I look forward to doing all that I can to contribute further to the development of the School of Optics: CREOL & FPCE, Chemistry, and UCF.”

You can find additional information about Steve Kuebler’s research interests at www.creol.ucf.edu.

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Biographical Note

I joined UCF’s faculty nearly 20 years ago, in August of 1984, coming here from the Optical Sciences Center at University of Arizona. UCF has grown a lot since then, and I have been pleased to grow along with it. My hope is to serve another 20 years here. So far I have taught 13 different courses, and have graduated 22 MS and 10 PhD students. I have never wanted to be anything except a teacher, and since I visited the Institute of Optics at Rochester when I was 16, I have studied Optics. My wife Maggie and I live on a small quiet farm in Geneva, where we have 2 horses and 3 dogs. Our son Eddie is a freshman at UCF in the Theatre Performance BFA program. As hard as I tried, I could not convince Eddie to become an electrical engineer – but, his heart is in acting, and you should follow your heart. I enjoy walking in the woods with my dogs, and I play bass guitar in the Methodist Church praise band in Geneva. When I am home, I enjoy reading about ancient history.

Current Research

Our current Infrared Systems Lab team consists of two other faculty from EE, two full-time research staff members, two postdocs, and seven PhD students. My most important job, research-wise, is recruiting the right people for the team – and the next most important job is proposal writing. We are very fortunate to have excellent support from Federal, State, and industry sponsors. Experimental work in this area is equipment intensive, and we are well equipped with a dedicated electron-beam lithography system, thin-film deposition apparatus, and a wide range of custom test equipment.

Our primary research mission in the IR Systems Lab centers on the use of advanced lithographic techniques to transition radio-frequency technologies such as antennas and frequency-selective surfaces to applications in the infrared portion of the spectrum. Our work sits at the fascinating boundary between Optics, Materials, and Electrical Engineering. The students obtain interdisciplinary training in all phases of device development – design, fabrication and characterization.

Most of the applications of our research are in the next generation of night vision devices, as well as remote sensing and medical imaging systems. Recently we have extended our work into the millimeter wave region, where new systems are being developed particularly for short-range imaging and obscurant penetration. We also have a long-standing program in infrared scene projection, developing projectors that create dynamic gray-level imagery for training applications.

Faculty Focus:

Dr. Glenn Boreman

UCF Trustee Chair & Professor of Optics

School of Optics
Faculty Focus:

Dr. Peter J. Delfyett

UCF Trustee Chair & Professor of Optics

Dr. Peter J. Delfyett, University Trustee Chair, Professor of Optics, ECE & Physics, joined the CREOL faculty in 1993. He was named University Distinguished Researcher of the Year in 1999 and in 2000 he won the UCF Excellence in Graduate Teaching Award. In 2001, he was honored as the UCF Pegasus Professor — the highest honor awarded by the University. Professor Delfyett’s latest honor came recently when he received a University of Central Florida’s Trustee Chair Professorship in recognition of his outstanding research activities in ultrafast optoelectronics.

Current Research

Dr. Delfyett heads the School of Optics Ultrafast Photonics (UP) group, a team that includes 12 graduate students and 3 senior research staff scientists. He and the UP group are currently studying semiconductor diode lasers for use in commercial applications including optical networking, signal processing, and novel instrumentation. The underlying technique they use is the generation of precisely timed, periodic, ultrashort optical pulses using optical modelocking techniques. These optical pulse trains produce a spectrum of colors that are discrete and periodically spaced in frequency — a spacing that is inversely proportional to the temporal period. Dr. Delfyett is exploring the use of these short pulses for timing applications in computers and in optical frequency combs used for discrete carriers of information in the optical domain (optical frequency and wavelength division multiplexing). The comb components can also be used in coherent signal processing, both for RF and optical arbitrary waveform generation. These techniques can be useful in applications ranging from novel imaging to the coherent control of fundamental optical physical processes. The figure shows an example schematic which illustrates the use of optical frequency combs in Time Division Multiplexing, Wavelength Division Multiplexing and Code Division Multiplexing modulation formats.

Biographical Note

Peter J. Delfyett received his Ph.D. from the Graduate School & University Center of the City University of New York in 1988. After graduation, he joined Bellcore, where he concentrated on the generation of ultrafast high power optical pulses from semiconductor diode lasers, for applications in applied photonic networks. Some of his technical accomplishments include the development of the world’s fastest, most powerful modelocked laser diode, the demonstration of an optically distributed clocking network for high speed digital switches and supercomputer applications; and the first observation of the optical nonlinearity induced by the cooling of highly excited electron-hole pairs in semiconductor optical amplifiers. While at Bellcore, Peter received numerous awards for his technical achievements, including the Bellcore Award of Appreciation and the Bellcore Synergy Award. He went on to garner national honors: the Black Engineer of the Year in 2000, and the coveted NSF Presidential Faculty Fellow Early Career Award for Scientists and Engineers. He has been highlighted in the New York Times, on ‘C-SPAN’, on "Mainstreetweek.com" and in a PBS Special on technical careers in optics and photonics.

Dr. Delfyett has published over 300 articles, and has been awarded 15 US Patents. He is a Fellow and Board of Governors member of IEEE-LEOS; the Editor-in-Chief of the IEEE Journal of Selected Topics in Quantum Electronics, and a former Executive Editor of IEEE LEOS Newsletter. He is also a Fellow of OSA.

Peter is a brilliant lecturer & dedicated educator. He currently serves on the Science Advisory Board of the Orlando Science Center, and he is a Founding Member of NSF’s Scientists and Engineers in the Schools Program: a motivational program to teach 8th graders about the benefits of science, engineering and technology.
Optics in the SouthEast
November 12-13, 2003

by Diana Randall

We had a special event here in November -- the School of Optics was host to the 4th annual Optics in the Southeast (OISE) conference. This meeting, which showcases research at organizations throughout the Southeastern United States, is co-sponsored by both OSA and SPIE, through their local chapters. We held the event here in the beautiful UCF Student Union on November 12-13 and had 175 official registrants as well as many walk-ins. The two-day meeting schedule included 20+ Corporate Exhibits, two poster sessions, research presentations in six topic areas, and a well-attended dinner (~140 showed up) with a Keynote presentation by Dr. Eric Buckland, entitled “Sifting through the Rubble: Optical networking in the telecom anti-bubble.” The six topic areas were: Non-linear Optics and Ultrafast Phenomena; Optical Science and Materials; Photonics, Communications and Devices; Optics Education; and Micro and Nano-Optics.

We also hosted a tour of the CREOL facilities that drew a good crowd and included a reception sponsored by our alumnus Robert Hopkins and his new company LaserPath Technologies. At $85 for pre-registration ($30 for students) with two lunches and dinner included, we gave the attendees a great bargain.

The School of Optics would like to thank everyone involved for making OISE 2003 the fantastic success that it was for us all. This includes our co-sponsors: OSA and SPIE; the School of Optics staff; our Industrial Affiliates and other corporate sponsors (including especially Ball Aerospace and Photonics Spectra) our Exhibitors; all of our great invited speakers; as well as the 2003 organizing committee and the co-organizers of our six Topical Conferences. Special thanks go to the many attendees and the presenters. Overall, we were all extremely pleased with both the turnout and the quality of talks and posters at this memorable event.

School of Optics Grad Students at OISE 2003
Poster Sessions I

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School of Optics Grad Students at OISE 2003
Poster Sessions I

Fall 2003 Graduates

Cafik Amrani    MS Optics
Michael Buschmann   MS Optics
Claudiu Cirloganu   MS Optics
Michael Mielke   PhD Optics
Mohammed Salem   MS Optics
Chien Wei Wen   MS Optics
Zahid Yaqoob   PhD Optics
Fransico Gonzales   PhD Electrical Engineering
Somsak Teerawattanasook   MS Electrical Engineering
Hong Shu   PhD Physics

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Debra Austin, Chancellor for College and Universities of Florida recently visited the School of Optics. (pictured left to right) Eric Van Stryland, Debra Austin, M.J. Soileau.

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