School of Optics/CREOL

HIGHLIGHTS

University of Central Florida

Winter/Spring 2002

www.creol.ucf.edu

Affiliates' Day 2002
April 5, 2002

Look for the pullout flyer inside!

Emil Wolf joins the School of Optics/ CREOL

Professor Emil Wolf has joined the University of Central Florida as "Provost's Distinguished Research Professor of Optics". He will spend every Fall semester here at the School of Optics/CREOL while continuing as the Wilson Professor of Optical Physics and Professor of Optics at the University of Rochester. His main areas of research are in physical optics, particularly in studies of coherence properties of optical fields; spectroscopy of partially coherent radiation, in diffraction and in scattering. He is the co-author, with Nobel Laureate Max Born, of the well-known book *Principles of Optics*, which was not long ago published in its seventh edition. Professor Wolf is also the co-author, with Leonard Mandel, of *Optical Coherence and Quantum Optics,* published in 1995. He is also the editor of *Progress in Optics*, an ongoing series of volumes containing review articles on optics and related subjects. Forty-two volumes have been published in this series to date, all under his editorship.

Professor Wolf is the recipient of numerous awards for his scientific contributions; and is an honorary member of the Optical Society of America, of which he was the President in 1978. He is also an honorary member of the Optical Societies of India and Australia; and is the recipient of seven honorary degrees from Universities in the Netherlands, Denmark, Great Britain, the Czech Republic, Canada and France.

He has a very rich history, growing up in Prague and fleeing Czechoslovakia in 1939 because of the Nazi occupation. He eventually ended up in Great Britain, where he earned a B.Sc. degree in mathematics from the University of Bristol in 1945, and the Ph.D. in 1948. He

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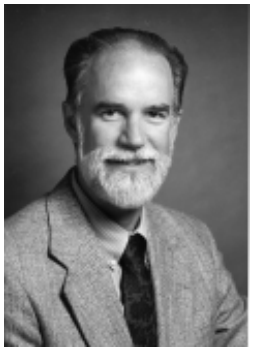
Director's Corner



Dr. Eric Van Stryland

Comings and Goings

I am very pleased to announce that Dr. Emil Wolf, co-author (with Max Born) of the "Bible" of Optics, ***Principles of Optics***, will be joining our faculty in the Fall 2002 semester. He joins us as "Provost's Distinguished Research Professor of Optics"; and he will spend every Fall semester here at the School of Optics/CREOL. Please see the article on Professor Wolf in this issue.

I must also announce that Dr. Martin Stickley has left us to take a permanent position with DARPA (Defense Advanced Research Projects Agency). This is a familiar position for him since he was among the first employees of this institution, which was originally named ARPA. We will miss Martin and his wife Dotti, but it is always nice to have a knowledgeable friend in Washington.

Professor Luis Elias (on phased retirement) has accepted a position with the University of Hawaii (UH). When he and John Madey, also now at UH, were at Stanford, they were the first to show free-electron laser (FEL) action. This move made sense to Luis's research by putting the best two people at the place where money is available for FEL research. We are initiating collaborations in areas of hyperspectral imaging, power beaming and high energy lasers with UH.

Having transferred their technology to Optium, Inc., Patrick LiKamWa and Guifang Li have returned to CREOL full time. It's great to have them back full-time.

Congratulations

Professor Nabeel Riza was highly honored recently by receiving the International Commission on Optics Prize and Abbe' Medal (see article in this issue). He was introduced to our new UCF Board of Trustees on Nov. 29, 2001.

Dr. George Stegeman won the CAOS (CREOL Association of Optics Students) Teacher of the Year Award 2001. CREOL students were asked to nominate the professor that, overall, impressed them the most in class (laboratory). The previous winner was Dr. M. G. "Jim" Moharam.

Irina Puscasu won the School of Optics/CREOL Student of the Year Award. The award is intended to recognize outstanding academic and scientific achievements of the graduate students within the School of Optics/CREOL. The winner of the award receives a Graduate Fellowship Enhancement in the amount of $500 provided by CREOL and a certificate. The award committee (consisting of 5 faculty appointed and chaired by the Associate Director for Academic Programs) selects three finalists who then make an oral presentation regarding one subject of their research. After this seminar, the committee decides the winner and it is announced on Industrial Affiliates Day. This activity was awarded the 1st place in the OSA Student Chapter Activity Idea Challenge, at the OSA 2001 Inaugural Leadership Conference. It was also featured in the June 2001 issue of SPIE's OE Magazine.

Florida Photonics Cluster

The former Florida Electro-Optics Industry Association (FEOIA) has changed it's name to the "Florida Photonics Cluster" (FPC). They have also hired Ray Mott as their new Program Director. We have been working with Ray on a number of projects, including co-sponsoring a large joint exhibit booth at several conferences. We have done this at CLEO, and Photonics West. Both times EDC-Metro Orlando was another Booth partner. We will do this again at OFC-2002 (Anaheim) in March. Look for us there, and find out more about the FPC at www.floridaphotonics.com

Potential New Optics Degree at UCF

Dr. Al Ducharme, a former CREOL graduate student, has returned to take a position with the Engineering Technology Department in the UCF College of Engineering and Computer Science. We will be working with him, the College, local industry and others in an effort to establish an undergraduate degree program in Optics Technology. It is hoped that this degree will fill a manpower gap in industry between optical design engineers and optics technicians.

New IGERT Program and Request for Donations for Telecom Facility

Principal Investigators Guifang Li, Jim Moharam, Peter Delfyett and Patrick LiKamWa have been awarded a major National Science Foundation (NSF) grant for graduate education under the Integrative Graduate Research, Education and Training (IGERT) program. This funding will have a significant impact to enhance research and graduate education in the area of Optical Communications and Networking (OCN). In the next five years, we will offer 60 fellowships to US citizens (and permanent residents) who are committed to pursuing Ph.D. degrees in the area of OCN. In addition to a $2.2 M grant from the National Science Foundation, the University is providing $1M of matching funds to this effort.

One of the cornerstones of this effort is the establishment of a test and measurement facility for devices, modules, and systems for OCN. This facility will not only be used for research and training of the Ph.D. students but will also be made available to industry. Of the total funding from NSF and the University, $0.6 M will be used towards the establishment of this facility. It will allow us to purchase equipment such as BERTs, oscilloscopes, OSAs, transmitters and receivers,

Director's Corner....continued

optical fibers, EDFAs, etc. We would like to build upon the availability of this equipment, which is a rare opportunity for any university, by making this test and measurement facility as helpful as possible to the students as well as to industry.

To that end, we are seeking cash and equipment donations from Industry. For making a donation, each company will receive several benefits, in addition to becoming a partner in this major effort to improve OCN education and research. These include:

· A plaque acknowledging the donation toward the test and measurement facility

· Notice on the door to the test and measurement facility acknowledging the donation

· Student exposure to the company and their products

· Access to the test and measurement facility.

Depending on the value of their donation, a company may also become a member of our Industrial Affiliates program. Please help out this effort for your future employees! (To donate call Guifang Li at 407-823-6811)

Upcoming Industrial Affiliates' Day, April 5, 2002.

See insert in this issue to register and mark your calendars.

Eric Van Stryland has accepted the position of Director of the School of Optics/CREOL

Emil Wolf joins the School of Optics/CREOL....continued

turned his attention to optics and began a long-standing professional relationship with Dr. Dennis Gabor (Nobel prize in physics for holography, 1971). Prof. Gabor introduced Emil to Max Born, who was at the University of Edinburgh and wanted to produce an English version of his book, *Optik*. Their collaboration became a much bigger project; eventually resulting in their coauthorship of an essentially new book, the now famous, *Principles of Optics*, which was first published in 1959 and is now in its seventh edition. It was in the mid-1950's that Dr. Wolf placed optical coherence theory on a firm theoretical footing in a number of seminal papers. His recent publication, with the late Leonard Mandel, of *Optical Coherence and Quantum Optics*, details this and other aspects of coherence theory.

In 1957 he visited New York University on a sabbatical and in 1959 was invited by the Director of the Institute of Optics, Robert Hopkins, to join their faculty. He has been at the University of Rochester since then except for extended visits to the University of California at Berkeley (Guggenheim fellow, 1966-7), University of Toronto (1974-75), and the University of Central Florida (Distinguished Visiting Professor, 1998). For a broader view of his many contributions to Optics, you can see "Selected Works of Emil Wolf, with Commentary," World Scientific Series in *20th Century Physics* – volume 29, 2001.

The School of Optics/CREOL's faculty, students and staff welcome Prof. Wolf and his wife Marlies to Orlando.

CREOL Graduates

The following CREOL Graduate Research Assistants have recently achieved educational milestones:

First Name	Last Name	Advisor	Program	Degree
Fall 2001				
Iulian	Codreanu	Boreman	Optics	PHD
Irina	Puscasu	Boreman	Optics	PHD
Mircea	Mujat	Dogariu	Optics	MS
Claudia	Mujat	Dogariu	Optics	MS
Lawrence	Shah	M. Richardson	PHY	PHD
Hughes	Francois-Saint-Cyr	K. Richardson	MMAE	PHD

Annual CREOL Fall Picnic, Cocoa Beach, Florida

The New World links with the Old World to develop a 'world first' technique for aerospace

UWE's team together with CREOL Professors. From Left to Right: Terry Flower, Mike Ackerman, Allan Keevil, Prof. Eric Van Stryland, Doug Nash, Alan Jocelyn, Jerome Way, Prof. Aravinda Kar

Recently, President Hitt and Eric Van Stryland signed a Memorandum of Understanding (MOU) with the University of the West of England (UWE), Bristol in the United Kingdom. The MOU was brought to UCF by Prof Stephen Hoddell, Assistant Vice Chancellor of UWE and Dean of the Faculty of Computing, Engineering and Mathematical Sciences (CEMS), who also signed the document at a special meeting on the 30th November.

The signing was in recognition of a series of pilot experiments conducted, during the past twelve months, by Dr. Aravinda Kar of CREOL and a team of six academics from the Aerospace Manufacturing Research Centre (AMRC), which is part of CEMS. In collaboration, eight 'superplastically formed' (SPF) specimens were produced using a high-energy laser, -- the first time this has been accomplished.

Superplastically formed test samples.

Prior to this achievement, the team of specialists had been working for over 18 months with the specific ambition of developing a new manufacturing process that will produce, from certain alloys commonly used in the aerospace industry, uniquely light, strong, corrosion resistant, elegant and complex structures. It has been known for many years that some alloys exhibit extraordinary high levels of ductility, or superplasticity, under certain high temperature conditions. The challenge has been to find a low cost, low thermal-mass technique that takes advantage of this phenomenon.

Aravinda Kar, associate professor of Optics, Mechanical, Materials and Aerospace Engineering, and Physics has been leading the research whilst AMRC has been sharing its ideas and its knowledge of superplasticity. Alan Jocelyn, Director of AMRC, said he was delighted to be working with the US's leading laser facility on this project, the ultimate aim of which is to integrate lasers and superplasticity into a cost effective, product based, manufacturing cell.

During the summer of 2001, the team produced demonstrator parts made from various alloys in experiments that took place in a special 'containment vessel' designed, built and tested by Terry Flower, Mike Ackerman and Doug Nash of AMRC, and shipped to the US in five boxes. After assembly, and with some relief, the first specimen was produced. Another team member Allan Keevil was able to record the tests on video, with the use of mirrors and careful lighting. It was the first time superplasticity has ever been seen.

Jerome Way, AMRC's expert on the metallurgical mechanisms of superplasticity, will be carrying out a full analysis of the specimens but already has said he is "delighted with the ease with which even the enormously difficult to shape alloys formed". It is likely to take another three years of research before the technique can be scaled-up and made sufficiently robust for industrial integration.

Will this collaborative research transform the production of the many essential metal products on which we all rely? Perhaps we will be looking for an SPF sticker on new automobiles in five years time!

School of Optics/CREOL
Highlights

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Nabeel A. Riza Wins ICO Prize

by Susan Loden, UCF Report Online

The world's image of UCF's CREOL/School of Optics is a bit sharper thanks to professor Nabeel Riza, winner of a top international award for scientists under the age of 40. "A mini Nobel Prize for a young optical scientist," Riza calls the International Commission for Optics (ICO) Prize. In August, Riza will travel to Florence, Italy to receive the Ernst Abbe Medal, the ICO prize citation and a stipend.

As the sole winner of this year's ICO award, he will deliver a lecture to his peers. "It is not awarded in a year if no one deserves it. It has been four years since the U.S. has won this prize," he says. Past winners include Christopher Dainty of Blackett Laboratories., Imperial College, U.K.; David Miller, Ginzton Laboratories., Stanford University, California; and Stephan Hell, Max Planck Institute, Germany.

"To win takes vision. You have to be humble at the feet of science and technology and you have to do your best and maybe you will invent these things and solve these problems and someone may reward you," Riza notes. The distinction reflects back onto UCF. "The university is becoming a leading optics center and this award is an example of why," he says, "I came here to challenge myself. One advantage of being a professor, you pretty much control your own destiny. You select your own students. You choose your own research area. You decide your own challenges and what you want to do. You have freedom to go against the flow and to break the path. UCF provides the infrastructure. The rest is up to the professor. He can reach for the stars. That is the way you excel, or not."

This native of Pakistan says he is being recognized for a body of work, including technical writings for 180 publications, that represents half of his professional life. Since becoming a UCF professor of optics and electrical engineering in 1995, Riza has been awarded 10 U.S. patents for his inventions. He already had 20 patents when he arrived, from his work as a doctoral candidate at the California Institute of Technology and in his five years with General Electric Corporate Research and Development in Schenectady, New York.

Riza sums up some of his achievements, saying, "I showed for the first time how optics could be used to completely control advanced radar systems. I showed how liquid crystal devices (similar to those in computer screens and wrist watches) could be used to make very clean, low noise fiber optics for switching and controlling Internet data traffic flow. I also demonstrated for the first time how one could use hair-thin mirrors on a silicon chip to act as a valve in light-flow fiber optics networks."

His innovations allow for more sophisticated military radar applications and can lower the cost of surfing the Internet around the world. There are also biomedical and materials applications, through an instrument that can measure materials defects on a molecular scale. "This prize is not only a testament of my work, but, also the vision of professor Boris Zel'dovich who nominated me," says Riza. "In a sense, I share this prize with Dr. Zel'dovich [School of Optics/CREOL professor] for his consistent encouragement that helped me excel as a younger colleague. In my opinion, he is the most famous physicist in the entire Southeast U.S. and a mentor to me."

Nuonics is Riza's company where he builds prototypes. He eventually hopes to manufacture some of his own inventions. "I am an industrial engineer, a scientist, a professor and an entrepreneur," he observes. Of his award and his work, he adds, "I don't realize what I have done. Maybe, when I'm 50 I will realize."

Photonics and Communications Laboratory

Shin-Tson Wu

Introduction

When I joined the School of Optics in July 2001, I immediately began to recruit for my new research team. In nearly half a year, my group has grown to 14 members, including 2 visiting professors, 5 post doctorates and 7 graduate students. In addition, another visiting professor is on his way to Orlando. I am especially indebted to DARPA (through Raytheon), AFOSR, the UCF I-4 project (sponsored by Applied Photonics), and two Taiwan display giants (Top-Poly and AUO) for their financial support of our group.

Our research activities focus in four areas: 1. Nanophotonics, 2. Optical phased arrays for laser beam steering and adaptive optics, 3. High birefringence liquid crystals for optical communications, laser hardening, and bio-photonics; and 4. Liquid crystal displays for desktop computers, TVs and mobile communications.

To handle different technical challenges, our group is organized into six research teams. Each team is led by a research scientist, with 2-3 graduate students assisting. Although each team is delving into different technical areas, all teams interact closely, and fertilize each other's ideas. That way, each individual is exposed to every team's progress.

I am grateful to my post doctorates and students for their diligent working attitude. I am amazed at their productivity. During the past six months, although we spent a great deal of time in building up new laboratories, our group has submitted five invention disclosures, and several papers to journals and the annual SID (Symposium for Information Display) conference. We have also presented two invited talks at the MRS and Photonics West conferences. I am delighted to grow together with these young scientists, and see their full potential being developed. Our group is already like a family, with older members helping out younger ones. My wife is even taking part in this team effort, by watching over some of the team members' personal needs.

Summary of Group Activities

Owing to the constraint of pending patents, I will only briefly highlight the research activities of each team.

Nanophotonics Team

Dr. Hongwen Ren is the project leader. Dr. Ren got his Ph.D. in Physics from Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences. His expertise is in liquid crystal/polymer composites, such as holographic polymer-dispersed liquid crystal Bragg grating and Fresnel lens. The liquid crystal droplets form photonic crystals in the polymer matrix. The direction of the liquid crystal droplets can be reoriented by an applied electric field, resulting in dynamically variable phase grating.

Recently, Dr. Ren's team invented a new gradient-index liquid crystal lens with tunable focal length. A patent is under preparation and will be filed shortly. This new device is expected to impact the future of bio-photonics and optometry. Another interesting device we are investigating is a switchable broadband polarizer. We use liquid crystal/polymer composites as electro-optic media to manipulate the output polarization of the incident white light. Switching times as fast as sub-milliseconds have been demonstrated.

Liquid Crystal Materials Team

Dr. Sebastian Gauza is the team leader. Dr. Gauza obtained his Ph.D. in Chemical Physics from the Military University of Technology in Warsaw, Poland. His thesis on "Antiferroelectric induced phases" has been nominated for the Glenn Brown Award this year. The Glenn Brown award was established by the International Liquid Crystal Society (ILCS) a few years ago. It is the highest ILCS award honoring the outstanding Ph.D. theses published in the past two years.

In addition to continuing the high speed antiferroelectric liquid crystal (AFLC) study, Dr. Gauza will be developing high birefringence nematic liquid crystal mixtures.

High birefringence liquid crystals are desperately needed for laser beam steering, reflective displays and bio-photonics. We are developing high performance LC mixtures for Raytheon's optical phased arrays (OPA). Similar to TFT-LCD, the phase change of each pixel in OPA is independently controlled by the applied voltage. Therefore, we can synthesize the phase profile digitally. OPA is a versatile device. It can be used to steer a laser beam for free space communication, network switching for fiber-optic communication, beam fanning, and electronic lens and prisms. On the other hand, AFLC has shown a 10 microsecond response time and analog switching. It is a strong contender for telecomm light switching and the next generation of flat panel displays.

Liquid Crystal Processing and Characterization Team

Dr. Qiong-Hua Wang is the project leader. Dr. Wang received her Ph.D. from the Department of Opto-electronic Technology, University of Electronic Science and Technology of China, Chengdu. She is an expert in projection CRT tube designs and projection optics. Before joining UCF, her group developed a 5 inch, state-of-the-art, high brightness CRT tube for high definition TVs. She has been invited to write an overview article for Information Display magazine, which is an official SID monthly publication similar to Physics Today published by the American Institute of Physics. Soon, we may all be buying new HDTV sets, without noticing that

the new tube inventor is at CREOL.

Our group has invested heavily in liquid crystal cell fabrication process and material characterization equipment. When completed, we should be able to fabricate test cells for proving concepts. Our second mission is to formulate practical liquid crystal mixtures and characterize their physical properties, e.g., refractive indices, elastic constants, dielectric constants, and rotational viscosity. These data are essential to device applications. In the past, we have developed physical models for understanding the origins of liquid crystal birefringence and viscosity. We are applying these models to designing high performance liquid crystal molecules.

Fast Response Time Team

Dr. Kit Choi is the project leader. Dr. Choi graduated from the EE department of Cambridge University, UK. His Ph. D. thesis was on high speed liquid crystal light switches for display and optical communications. After graduation, he spent about two years at Unipac Optoelectronics for developing new reflective displays.

At CREOL, Dr. Choi will continue to work on display projects and fast response liquid crystal devices. Response time is a critical issue for almost all liquid crystal devices. For a 5 micron nematic liquid crystal cell, response time is around 20-30 ms. For the next generation of LCD TV's, the required response time is less than 8 ms. In our I-4 project, sponsored by Applied Photonics, the response time requirement is much more stringent. We are evaluating several approaches for meeting this challenge.

Wide Viewing Angle Team

We are so grateful that Professor Tom Wu (no relation) will take the lead on this important project. Tom is currently an assistant professor in the UCF Electrical Engineering department. Tom got his Ph.D. from the EE department at the University of Pennsylvania, in 1999.

Tom is proficient in numerical modeling. He has developed a finite element analysis method for calculating the angular dependent physical properties of liquid crystal cells. Results in cholesteric liquid crystals agree well with those obtained from the 4x4 matrix method. The new technique that Tom's team developed shows better converging behavior when 3D presentations are required. Presently, phase compensation, multi-domains, and in-plane switching are the three major approaches for achieving a wide viewing angle. Each technique has its own merits. We are investigating new device structures for widening the viewing angle.

Dr. Wu and his research group.

Transflective Liquid Crystal Display Team

Dr. Xinyu Zhu is the project leader. Dr. Zhu received his Ph.D. in Physics from Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences. He finished his Ph.D. degree at age 25, two years ahead of an ordinary candidate. He jumped one year in elementary school and another year in high school. His thesis was dealing with direct-view liquid crystal displays, especially the reflective type.

Transmissive liquid crystal displays, such as those in desktop and notebook computers, exhibit excellent performance in color saturation and high contrast. However, outdoors the images are washed out by sun light. In contrast to this, a eflective display uses ambient light for reading images. Its power consumption is low, and it is ideal for outdoor mobile communications. A deadly issue for the reflective display is that it loses readability in dark ambient light. A compromise would be to develop a transflective display where each pixel is split into two parts: transmission and reflection. The reflective pixels would be responsible for bright ambient and the transmissive pixels for dark ambient. Finding a proper operation mode for obtaining high reflectance and high transmittance is a challenging problem; but our team has made important breakthroughs in this area.

Potential collaborations with other CREOL research groups:

Our team is not working in isolation here. We have found tremendous opportunities to collaborate with other CREOL research groups. For example, Professor Bass' group is developing fascinating conformal 2D and 3D displays with amazingly high luminance. Professor Rolland's group is developing high resolution head-mounted displays for telemedicine. Professors Hagan and Van Stryland's group is working on optical limiters using liquid crystals as passive light switchs. Our new compounds with different electronic structures may expand the limiter bandwidth to the whole visible spectrum. Professor Dogariu's group is working on a partial coherence laser beam for compensating atmospheric phase aberrations. Our optical phase arrays will be ideal for this purpose. Professor Kar's high power YAG laser could help us test the power handling capability of optical phased arrays in order to steer a high energy laser. Professor Riza's group is working on spatial light modulators for fiber-optic communications. Our high speed liquid crystal shutter could be useful. Professor Johnson's group is working on diffractive optics. This technology will benefit our high brightness reflective display programs. Professor Belfield's chemistry group can help us synthesize new liquid crystal compounds. Professor Sider's X-ray could help us identify liquid crystal structures and improve our molecular designs. And finally, Professor Harvey's optical design expertise will help in modeling our gradient-index liquid crystal lens. As a matter of fact, we have just submitted a joint proposal to DARPA in response to a BAA on "bio-optic synthetic systems."

Student News from the past

by Mircea Mujat
CAOS President

It is always good to look back to see what we've been up to last year and try to plan and hope for a better one. This was 2001 for CAOS:

I think the most successful activity last year was "The School of Optics/CREOL Student of the Year Award". The award is intended to recognize outstanding academic and scientific achievements of the graduate students within our school. Based on the submitted application materials, the award committee (consisting of 5 faculty appointed and chaired by the Associate Director for Academic Programs) selects three finalists that make a 15 minutes oral presentation regarding one subject of their research. After this seminar, the committee decides the winner that receives a Graduate Fellowship Enhancement in the amount of $500 provided by the School of Optics/CREOL and a certificate. The winner in 2001: Irina Puscasu. Who's next? This program was awarded the 1st place in the Student Chapter Activity Idea Challenge by OSA at its 2001 Inaugural Leadership Conference, after a very passionate presentation made by Sergey. It was also featured in SPIE's OE Magazine in June 2001 issue. OSA Student Chapter initiated the program and proposed the procedure and the criteria for selecting the winner.

"CAOS Teacher of the Year Award" is meant to acknowledge excellence in teaching in The School of Optics/CREOL. All graduate students are asked to nominate the professor that, overall, impressed them the most in class (laboratory) in terms of clarity of the message, lecture flowing, availability outside class, handouts, feedback on homework and exams, fairness in grading, etc. The 2000 winner was Dr. Jim Moharam. Dr. George Stegeman won the award in 2001. Who's next? Being asked by the crowd to make a speech, Dr. Stegeman mentioned that among all the awards he got along his prestigious career, this is the one he values the most. In addition to the traditional certificate, we prepared for him a plaque. Thank you for being excellent teachers!!!

Faculty and Student seminars continued with interesting and exciting presentations appreciated by a large audience (sometimes more people than available seats).

We have started a series of seminars in CREOL about: career connections, resume and cover letter critique, interview techniques, targeting and choosing employers, job search strategies, and other career related issues. Annie Ware from the Career Resource Center at UCF made 3 presentations. We continued this series with a new speaker: Courtney Lewis, who made a very well appreciated presentation on Interviewing Techniques. Resume and Job Searching Strategies will soon follow.

In order to have a better idea about potential employers and what a possible job for us would be like, and to expand our students' knowledge about the local Optics Industry, we have initiated and are organizing visits of groups of students from our school to Industrial Affiliates facilities. We have started in 2001 with local companies, based in Orlando: SurgiLight and Schwartz Electro-Optics. We are currently planning visits to Alcon, Control Laser, and a presentation in CREOL of Litton Laser.

CAOS introduced two bills at the Student Government (SGA) at UCF to fund student participation at national conferences. We obtained $6200 for CLEO 2001 and $4600 for CLEO 2002 to allow students that do not make presentations at the conference to take benefit from attending it. Thanks are in order here mainly to our former Senator, Sergey and our two speakers at SGA, Slava and Joel. In addition to this, many students were awarded travel grants (like New Focus Travel Grant) for attending conferences.

We obtained $1800 from SGA and $1000 from OSA to fund two new display projects. One was finished (and already used); the other one will be finished soon. We actually plan to finish ASAP all our ongoing projects and display them on a permanent basis in CREOL's main lobby.

In 2001 we have participated in many outreach activities: we have guided so many tours in CREOL that I lost count of both numbers of tours and visitors; students helped with the CREOL booth at various conferences and expositions, participated as judges at science fairs. CREOL was represented in workshops and forums like "Expanding your horizons in Engineering, Science and Mathematics" and "Introduce a girl to engineering". CAOS is participating in General Mills Box Tops for Education and Campbell's Labels for Education Label Collection Drive on behalf of the local schools.

To make us better known in the Optics Community, we published articles that reflect our activity. For details, please check http://www.creol.ucf.edu/~osa/publications.html

At the Industrial Affiliates Day 5 students made oral presentations well appreciated by a large audience. Students also presented posters of their research and offered lab tours.

Let's not forget our 3 parties: The Spring Thing, the Fall Picnic and the Holiday Party, and our first ever CREOL Tennis Tournament sponsored by SGA ($850 - Thanks go here to Arnaud, Javier and Sergey).

Infinite Photonics forms Strategic Relationship with UCF/ CREOL and Locates in Orlando

By Jeff Bullington, Infinite Photonics

In early 2001 Infinite Photonics, Inc. had developed and demonstrated a substantial technological advancement for laser diode technology and was examining locations to place our development and production facilities . At a Photonics trade show Infinite made contact with the Director of the CREOL and representatives of the economic development organization for the city of Orlando. We were encouraged to visit the city, and CREOL, to examine the technology and business opportunities. What Infinite found was a state-of-the-art facility with world-class expertise in the Photonics technical areas that we were focusing on as a business. CREOL's expertise was and is embodied in its diverse but complementary group of researchers who were focused on a number of technological areas. These were areas in which Infinite had strategic long-term basic research needs, including grating-based micro-optical elements and device applications. In the area of grating-based micro-optical elements, CREOL has several key researchers who have developed modeling, simulation, and prototyping expertise. Most organizations that had assembled these capabilities used prototyping tools that did not have a direct analog to production processes. The CREOL staff has taken the extra technological step that includes the use of advanced photolithography tools (high resolution steppers). Steppers enable CREOL to demonstrate a production analog to the prototypes that are created by any number of techniques. For example, CREOL and/or AMPAC, at UCF, have focused ion beam milling (FIB), holographic, and e-beam prototyping equipment. This capability is closely coupled with CREOL's device applications expertise.

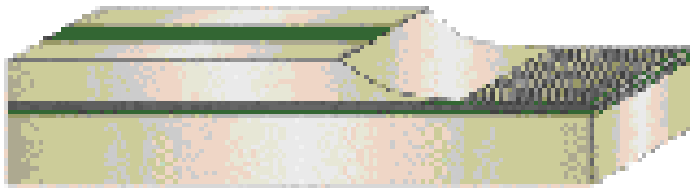

Figure 1. A low reflectivity grating-coupled laser diode (GCSEL).

These attributes are critical to Infinite's long term technology development needs, since our technology is based on a proprietary low reflectivity grating-coupled laser diode. See Figure 1.

Grating-coupled laser diodes were first demonstrated during the mid to late 1970s. The original technology had great potential but suffered from several technological and production issues. The first issue was that the device structure had a multitude of reflections which created several independent laser resonators. The second technology issue was the complexity of the grating structures required to optimize the performance of the diode. They were too complex to make easily by holographic techniques. During subsequent years, prototyping techniques such as FIB and e-beam photolithography were developed. This enabled the generation of complex grating structures which can control the linewidth, wavelength, and mode. These can be optimized to add optical power to the emissions of a laser diode.

However, it has only been in the last several years that steppers, driven by the silicon-based semiconductor industry, have achieved a resolution of =0.15mm, and have become commercially available in production.

The convergence of production techniques for high spatial frequency gratings, a low reflectivity device structure, coupled with grating design, simulation, and prototyping, has the potential to create a new class of laser diode technology that forward integrates the discrete optical elements (lenses) on a chip. These integrated devices can eliminate the need for discrete lenses and their associated hand assembly. Discrete lenses and hand assembly are a significant portion of the cost of photonic based products. These products include source and pump diodes for communications and materials processing.

By combining our capabilities with those of CREOL, Infinite Photonics was able to obtain a $12M multi-year contract from DARPA (Defense Advance Research Project Agency) to develop and demonstrate the grating-coupled laser diode technology. This technology has the potential of applying the economies of scale achieved in the silicon industry to the photonics industry.

Infinite Photonics intends to leverage their relationship with the CREOL to enable the growth of the Photonics based industry in the greater Orlando area.

Schwartz Fellowship Fund

The Schwartz Fellowship Fund has been created in honor of Bill Schwartz for all he did to help CREOL, and the laser and optics industry in Central Florida. Income from it will support student fellowships. Dr. Van Stryland would be happy to discuss a donation with you at 407-823-6834.

Correction: In the article in the Fall 2001 issue of Highlights, "CREOL Develops 4 Micron Laser for U.S. Air Force, by Hans Jenssen and Rita Peterson, two references were inadvertently cut off:

A.M Tabiryan, "New, efficient, room temperature mid-infrared laser at 3.9 ?m in Ho:BaY2F8 and visible Pr:LiYF4 laser for holography", Ph.D Dissertation, Physics Dept/School of Optics/ CREOL, UCF, 2000.

A.M Tabiryan, H.P. Jenssen, S.C. Butcher, H.J. Hoffman, "Multi-wavelength solid state infrared laser", U.S. Patent Pending.

Books, Book Chapters, Patents

Book Chapter:

M. Bass and A. Kar, "Laser Materials Interactions," in "Encyclopedia of Science and Technology, Third Edition, Volume 8 (Academic Press, San Diego, 2001)

Books:

S. T. Wu and D. K. Yang, "Reflective Liquid Crystal Displays," (Wiley-SID, 2001).

Patents:

M. Bass and H. Jennsen, "Display media using emitting particles dispersed in a transparent host," US Patent No. 6,327,074.

S. T. Wu and M. Neubert, "Polar diphenyldiacetylene liquid crystals," U.S. patent 6,312,618 (Nov. 2001).

H. W. Ren and S. T. Wu, "Electronic lens using inhomogeneous nano-scale liquid crystaldroplets," (In preparation to file, Feb.2002).

Y. B. Huang, X. Y. Zhu, S. T. Wu and H. P. Hsieh, "Transflective Liquid crystal displays," (Invention Disclosure submitted, Jan. 2002).

C. S. Wu and S. T. Wu, "Reflective and transflective liquid crystal displays using a wire grid reflector," (Invention Disclosure submitted, Feb. 2002).

K. W. Choi and S. T. Wu, "High brightness transflective LCD by partial switching,"(Invention Disclosure submitted, Feb. 2002)

K. W. Choi and S. T. Wu, "Transflective displays using twisted nematic liquid crystal cells," (Invention Disclosure submitted, Feb. 2002).

Papers, Talks Published/ Presented

Papers Published:

I. Puscasu, W. L. Schaich, G. Boreman, "Resonant enhancement of emission and absorption using frequency selective surfaces in the infrared," Infrared Physics and Technology 43, 101-107 (2002).

F. Hernandez, W. Shensky, I. Cohanoschi, D. Hagan and E. VanStryland, "Indis ink/ carbon disulfide creates laser safety device," Laser Focus World, November 2001.

O. M. Efimov, L. B. Glebov, K. A. Richardson, E. Van Stryland, T. Cardinal, S. H. Park, M. Couzi, J. L. Brunéel, "Waveguide writing in chalcogenide glasses by a train of femtosecond laser pulses," Optical Materials, v. 17 (2001) 379-386.

N. A. Riza and Sajjad A. Khan, "Photonic Beamformer with Flexible Interface for Phased Array Antennas," in IEEE LEOS 14th Ann. Mtg. Conf. Proc. 2, IEEE Catalog Number: 01CH37242, 816-817, November 2001.

P.J. Delfyett, Jr., C. M. DePriest, T. Yilmaz, "Modelocked Semiconductor Optical Clocks for Applications in Photonic Sampling," submitted to IEEE Circuits&Devices Magazine.

T. Yilmaz, C. M. DePriest, A. Braun, J. Abeles, and P. J. Delfyett, Jr., "Complete AM and Residual PM Noise Measurements of an External Cavity Semiconductor Laser Hybridly Modelocked at 10 GHz," Proceedings of the 14th Annual Meeting of the IEEE Lasers and Electro-Optics Society (LEOS 2001), Technical Digest (Institute of Electrical and Electronics Engineers, New York, 2001), Vol. 2, pp. 906-907.

T. Yilmaz, C. M. DePriest, and P. J. Delfyett, Jr., "Complete noise characterization of external cavity semiconductor laser hybridly modelocked at 10 GHz," Electron. Lett. 37, 1338-1339 (2001).

C. M. DePriest, T. Yilmaz, P. J. Delfyett, Jr., "Ultralow-noise active modelocking of semiconductor diode lasers for optoelectronic analog-to-digital conversion," presented at Optics in the Southeast, Clemson, SC, October 4-5, 2001, paper SE04-07.

T. Yilmaz, C. M. DePriest, P. J. Delfyett, Jr., J. H. Abeles and A. Braun, "Measurement of residual phase noise in 10 GHz pulsetrain using modified Michelson optical frequency discriminator," in OSA Trends in Optics and Photonics (TOPS) Series Vol. 49: Ultrafast Electronics and Optoelectronics (UEO 2001), Technical Digest, Postconference Edition (Optical Society of America, Washington, D.C., 2001), pp. 63-66.

R. A. Negres, J. M. Hales, A. Kobyakov, D. J. Hagan, E. W. Van Stryland, "Two-Photon spectroscopy and analysis using a white-light continuum probe," Opt. Lett., 27, 4 (2002).

A. Rapaport and M. Bass, "Role of Spontaneous Emission in the Dynamics of Luminesence Decay of Four Level Systems," J. Luminescence, Spring 2002

M. Canva, G.. Roger, F. Cassagne, Y. Levy, A. Brun, F. Chaput, J. P. Boilot, A. Rapaport, C. Heerdt and M. Bass, "Dye doped sol-gel materials for two-photon absorption induced fluorescences," Journal of Optical Materials,Fall 2001.

A. Rapaport, L. Weichman, B. Brickeen, S. Green, and M. Bass, "Laser Resonator Design Using Optical Ray Tracing Software: Comparisons with Simple Analytical Models and Experimental Results," IEEE J. of Quantum Electronics 37, 1401-1408, (2001).

S. T. Wu, T. S. Mo, A. Y. G. Fuh, S. T. Wu, and L. C. Chien, "Polymer-dispersed liquid crystal holographic Gratings doped with a high dielectric dopant," Jpn. J. Appl. Phys. 40, 6441-5 (2001)

W. C. Lee, C. S. Hsu and S. T. Wu, "Sensitivity of the photo-crosslinkable polyimide for liquid crystal alignment," Jpn. J. Appl. Phys. 40, 5942-6 (2001)

S. T. Wu, "High birefringence liquid crystals for laser beam steering," Proceedings of the 10th AIAA/BMDO Technology Conference, Vol.1, p. 85-91 (Williamsburg, Virginia; July 23-26, 2001).

K. H. Fang-Chiang, S. T. Wu and S. H. Wang, "New electrode design for minimizing fringing field effect of liquid-crystal-on-silicon," Asia Display Conference Proceedings, p.1723-4 (Nagoya, Japan, Oct.16-18, 2001).

L.B. Glebov, "Volume Diffractive Elements in Photosensitive Inorganic Glass for Beam Combining," Proceedings of Solid State and Diode Lasers Technical Review. Albuquerque (2001), FA-5.

L.B. Glebov, "Optical absorption and ion-

ization of silicate glasses,"(invited paper) Laser-induced damage in optical materials:2000 Proceedings of SPIE, v. 4347 (2001) 343-356.

O. M. Efimov, L. B. Glebov, S. H. Park, K. A. Richardson, E. Van Stryland, T. Cardinal, M. Couzi, J. L. Brunéel, "Waveguides in chalcogenide glasses produced by a train of femtosecond laser pulses," Laser-induced damage in optical materials:2000, Proceedings of SPIE, v. 4347 (2001) 469-477.

F.E. Hernandez, W. Shensky III, I. Cohanoschi, D.J. Hagan, and E.W. Van Stryland, "India ink/ carbon disulfide creates laser safety device." Laser Focus World 37 125 (2001). (Invited paper).

E.W. Van Stryland, S.S. Yang, F.E. Hernandez, V. Dubikovsky, W. Shensky III, D.J. Hagan, "Cascaded optical limiters and modeling." Nonlinear Optics 27, 181 (2001).

F. E. Hernández, W. Shensky III, Ion Cohanoschi, D. J. Hagan and E. W. Van Stryland, "Viscosity Dependence of Optical Limiting in Carbon Black Suspensions," Applied Optics-LP 41, 1 (2002).

A. Cavalleri, C.W. Siders, C. Rose-Petruck, R.J. Jimenez, Cs. Toth, J.A. Squier, C.P.J. Barty, K.R. Wilson, K. Sokolowski-Tinten, M. Horn von Hoegen, and D. von der Linde, "Ultrafast x-ray measurement of laser heating in semiconductors: Parameters determining the melting threshold," Phys. Rev. B 63, 193306 (2001).

A. Cavalleri, Cs. Toth, C. W. Siders, J. A. Squier, F. Raksi, P. Forget, and J. C. Kieffer, "Femtosecond Structural Dynamics in VO2 during an Ultrafast Solid-Solid Phase Transition," Phys. Rev. Lett. 87, 237401 (2001).

A. Cavalleri, Ch. Blome, P. Forget, J.C. Kieffer, S. Majnan, C. W. Siders, K. Sokolowski-Tinten, J.A. Squier, Cs. Toth, D. von der Linde, "Femtosecond X-ray Studies of Photo-induced Structural Phase Transitions," Phase Transitions, (accepted, to be published 2002).

C.W. Siders, G. Rodriguez, J.L.W. Siders, F.G. Omenetto, and A.J. Taylor, "Measurement of Ultrafast Ionization Dynamics of Gases by Multipulse Interferometric Frequency-Resolved Optical Gating," Phys. Rev. Lett. 87, 263002 (2001).

G. Rodriguez, C.W. Siders, C. Guo, and A.J. Taylor, "Coherent Ultrafast MI-FROG Spectroscopy of Optical Field Ionization in Molecular H2, N2, and O2," IEEE J. Sel. Top. Quantum. Electron. 7(4), 579 (2001).

K. Sokolowski-Tinten, M. Horn von Hoegen, D. von der Linde, A. Cavalleri, C.W. Siders, F.L.H. Brown, D.M. Leitner, C. Toth, J.A. Squier, C.P.J. Barty, K.R. Wilson, M. Kammler, "Transient Lattice Dynamics in fs-laser-excited semiconductors probed by ultrafast x-ray Diffraction," J. de Physique IV 11, 473 (2001).

D. von der Linde, K. Sokolowski-Tinten, C. Blome, C. Dietrich, P. Zhou, A. Tarasevitch, A. Cavalleri, C.W. Siders, C.P.J. Barty, J.A. Squier, K.R. Wilson, I. Uschmann, and E. Forster, "Generation and application of ultrashort x-ray pulses," Laser and Particle Beams 19, 15 (2001).

A. Cavalleri, C.W. Siders, K. Sokolowski-Tinten, Cs. Toth, Ch. Blome, J.A. Squier, D. von der Linde, C.P.J. Barty, and K.R. Wilson, "Femtoseocnd X-ray Diffraction," Opt. & Phot. News 12(5), 28 (2001).

J. Ellis, P. Caillard, and A. Dogariu, "Off-Diagonal Mueller Matrix Elements in Backscattering from Highly Diffusive Media", J. Opt. Soc. Am. A19, 43, 2002.

Seminar Presentations:

L. Glebov, "Diffractive optical elements in photo-thermo-refractive glass," Litton Laser Systems, invited talk. April 2001.

L. Glebov, "Volume Diffractive Optical Elements in Photosensitive Inorganic Glasses," University of Jena, Germany, invited talk, July 2001.

L.B. Glebov, V. Smirnov, and C. M. Stickley. "A new approach to robust optics for HEL systems," Wright Paterson Air Force Base, Material Science Laboratory, invited talk, December 2001.

A. Cavalleri, C. Toth, C. W. Siders, J. A. Squier, F. Raksi, P. Forget, and J. Kieffer, "Femtosecond structural dynamics during a laser-driven, solid-solid phase transition in VO2," Invited Talk, Photonics West, January 24, 2002.

C.W. Siders, "Femtosecond X-ray Diffraction Studies of Ultrafast Phase Transitions," Invited Talk, Purdue University ECE Graduate Seminar, September 27, 2001.

C.W. Siders, "Ultrafast X-Ray Diffraction," Invited Talk, Femtosecond Nonlinear Optics Workshop, University College Cork, Cork, Ireland, September 5-7, 2001.

C.W. Siders, "Femtosecond X-Ray Diffraction with Table-Top Laser-driven K-alpha Sources," Invited Talk, DoE Workshop on Scientific Applications Of Ultrafast, Intense, Coherent X-Rays Washington DC, May 4-5, 2001.

C.W. Siders, "Direct Observation of Ultrafast Non-thermal Melting by Ultrafast X-ray Diffraction," Invited Talk, X-Ray Physics Gordon Research Conference, July 21–26, 2001.

A. Cavalleri and C.W. Siders, "Direct Observation of Ultrafast Non-thermal Melting by Ultrafast X-ray Diffraction," Invited Talk, Photoinduced Phase Transitions, their Dynamics and Precursor Phenomena, Epochal Tsukuba, Japan, November 14–16, 2001.

C.W. Siders, "Ultrafast Dynamics of Semiconductors Seen With Femtosecond X-ray Diffraction," Invited Talk, DoD Workshop on Ultrafast Lasers, Kirtland AFB, New Mexico, March 21–22, 2001.

Papers Presented at Conferences:

S. T. Wu, "Molecular design strategies for high birefringence liquid crystals," (Invited paper) MRS Fall Symposium (Boston, MA, Nov. 2001).

C. H. Wen, Y. H. Fan, S. T. Wu, R. Dabrowski, O. Catanescu and L. C. Chien, "0Side chain effects on high birefringence liquid crystals," (Invited paper) Photonics West (San Jose, CA, Jan. 2002).

J. Hales, R. Negres, A. Kobyakov, D. J. Hagan, E. W. Van Stryland, "Effects of temporal walkoff in pump-probe measurements of two photon absorbers," OSA Annual presentation, Long Beach, CA., October, 2001.

O.M. Efimov, L.B. Glebov, V. I. Smirnov, "High-efficiency narrow-band holographic reflective filter for DWDM.," CLEO Baltimore, MD, May 2001.

L.B. Glebov, "Volume Diffractive Elements in Photosensitive Inorganic Glass for Beam Combining," Solid State and Diode Lasers Technical Review. Albuquerque, NM, May 2001.

L. B. Glebov, L. N. Glebova, R. R. Rakhimov and D. E. Jones, "Magneto-induced microwave conductivity in silicate glass doped with transition elements," XIX International Congress on Glass. Edinburgh, UK, July 2001.

O.M. Efimov, L.B. Glebov, V. I. Smirnov, "Diffractive Optical Elements in Photosensitive Inorganic Glasses," SPIE 46th Annual Meeting, San Diego, August 2001.

L.B. Glebov, "Intrinsic Laser-Induced Breakdown of Silicate Glasses," Boulder Damage Symposium, Invited, Boulder, CO, October 2001.

L.B. Glebov, L.N. Glebova, A.P. Tirpak, "Separation of Absorption Spectra of Ce^{3+} and Ce^{4+} in Silicate Glass," PAC RIM IV, Hawaii, November 2001.

O.M. Efimov, L.B. Glebov, L.N. Glebova, "Volume Increment in Photo-Thermo-Refractive Glass," PAC RIM IV, Hawaii, November 2001.

L.B. Glebov, L.N. Glebova, E.N. Boulos, "Separation of Absorption Spectra of Mn^{3+} and Mn^{2+} in Soda-Lime Silicate Glass," PAC RIM IV, Hawaii, November 2001.

W. Shensky III, F.E. Hernandez, I. Cohanoschi, V. Dubikovskiy, E.W. Van Stryland, D.J. Hagan, "Dual-focal plane passive optical limiter for nanosecond pulses." ICALEO (2001), Jacksonville, FL.

C. R. Mendonça, F. E. Hernández, D. J. Hagan, and E. W. Van Stryland, "Two-photon induced birefringence in azobenzene dye films," OSA'01, Long Beach, California, USA.

G. Popescu and A. Dogariu, Microrheology in localized coherence volumes, OSA Annual Meeting, Long Beach, CA 2001.

M. Mujat and A. Dogariu, Light scattering in granular chiral media, OSA Annual Meeting, Long Beach, CA 2001.

P. J. Delfyett, C. DePriest, M. Mielke, E. Park, T. Yilmaz, "Hybrid WDM-OTDM Technologies for LANs, Optical Sampling, & Photonic Signal Generators," presented at DARPA WDM Workshop, Los Angeles, CA, June 28-29, 2001 (INVITED).

P. J. Delfyett, C. DePriest, E. Park, T. Yilmaz, "Progress in ultralow noise from modelocked semiconductor optical amplifier clocks," presented at DARPA Photonic Analog to Digital Converter Technology Program Review, San Diego, CA, June 19-21, 2001.

T. Yilmaz, C. M. DePriest, P. J. Delfyett, J. H. Abeles, A. Braun, "PM noise measurements of an actively modelocked external-cavity semiconductor ring laser at 10 GHz," in Enabling Photonic Technologies for Aerospace Applications III, Eric Donkor, Andrew R. Pirich, and Edward W. Taylor, eds., Proc. SPIE 4386, 47-52 (2001).

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