The visual excitement of optics hooked Mark Gruneisen at a young age. But later in life, it was the intellectual excitement that reeled him in. “When I was a small child, my oldest cousin Larry worked for Kodak,” he says. “My family visited and toured the facilities where he gave me a lens as a souvenir. I was intrigued with how the lens would form images on a piece of paper, and later, how lenses could be used in tandem to make telescopes and microscopes.” By the time he was in college, and then graduate school, the physics involved in the study of optics had begun to fascinate him.

“As a field of study, optics is both aesthetic and challenging, and conveniently lends itself to quantitative analysis,” he says. Gruneisen is the lead author of the paper named the winner of the 2004 Rudolf Kingslake Medal and Prize: “Programmable diffractive optics for wide-dynamic-range wavefront control using liquid-crystal spatial light modulators.”

Gruneisen is principal investigator for the Advanced Wavefront Control Program in the Beam Projection and Compensation Group of the Air Force Research Laboratory’s (AFRL; Kirtland AFB, NM) Directed Energy Directorate (DED). Lubin provides technical support to the same group, and DeSandre is deputy of the Precision Engagement Product Line of the DED. Rotgé and Dymale both work for Boeing LTS and are based at AFRL. Rotgé is a senior electro-optic scientist, and Dymale is a senior engineer.

The group’s current work evolved from an earlier Air Force program that developed optically addressed spatial light modulators (OASLMs) as real-time holographic recording media for compensating aero-optics effects, but a major shortcoming was low diffraction efficiency, says Gruneisen. “Not surprisingly, people weren’t interested in optical systems with less than 1% throughput.”

A decade ago, the group began studying the feasibility of developing thin optical membranes as deployable primary mirrors for space-based telescopes. “Mechanical and optical tolerances would have to be relaxed,” Gruneisen says. “This, in turn, would require a new technology for compensating...”
“As a field of study, optics is both aesthetic and challenging, and conveniently lends itself to quantitative analysis.”

—Mark Gruneisen
Kujawinska Says Farewell as President

This year was very special for me as the President during the Society’s 50th anniversary year. This was a time to look back on how the Society went from photography to photonics, but also, more important, working out a strategy for the next 50 years.

The greatest help to me in this future planning have been the SPIE Board of Directors; SPIE staff; outcomes from the Presidential Advisory Committees (PACs) in Asia, Europe, Latin America, and India; as well as my meetings with the optics and photonics communities in India, Mexico, Malaysia, Singapore, the United States, Germany, France, Belgium, Ukraine, Russia, Korea, China, and, of course, Poland.

These meetings gave me a better understanding of the needs and desires of our members, and, together with the directions given by the PACs, began an SPIE strategy that continued on page 43

SPIE Newsroom, SPIE Professional to Debut in January

Two new publications—one online, one in print—will provide the information you need to excel in your profession.

In-depth Technical News
SPIE Newsroom articles will range from industry news to in-depth technical features all based around several technical communities. The communities include Biomedical Optics & Medical Imaging, Lasers & Sources, Nanotechnology, Remote Sensing, Micro/Nanolithography & Fabrication, and Communications & Networking, just to name a few. Each community will have its own front page and set of resources.

In addition to near-daily updates, the website will provide multimedia content, such as streaming video and animation, as well as RSS feeds and robust search capabilities.

SPIE Newsroom will provide timely news and information in an online environment, allowing SPIE to exploit the many search, linking, and interactive capabilities of the Internet.

Photonics Professionals
While most of the content on SPIE Newsroom will be accessible to all readers, members will continue to receive a print magazine exclusively. The new magazine, SPIE Professional, will address members in an entirely new way.

With SPIE Professional, the Society recognizes that members aren’t just defined by technical community but also by their career roles. A professional may be an entrepreneur, a creator, a student, an educator, an employee, a manager, or a mentor, as well as an SPIE member.

The content provided in SPIE Professional will focus on the profession of optics and photonics and the issues that impact SPIE members working within it. Look for articles on topics such as continuing education, case studies from photonics entrepreneurs, intellectual property basics, professional ethics, industry trends, and more.

Malgorzata Kujawinska (front right) with student scholarship recipients at Optics & Photonics 2005.
Photonics West 2006, 21–26 January, will be brimming with special events and new developments, from new technology areas in the technical program to a brand new hall for the exhibition.

New topics incorporated into Photonics West 2006 are: mechanisms for low-level light therapy; multimodal biomedical imaging; endoscopic microscopy; biophotonics and immune responses; ultrasensitive and single-molecule detection technologies; gallium nitride materials and devices; zinc oxide materials and devices; and silicon photonics.

The usual site of Photonics West, the San Jose McEnery Convention Center, has added a new South Hall, expanding the available exhibition area at the convention center by 80,000 square feet, bringing the total convention center space to an incredible 223,000 square feet.

With about 800 exhibiting companies taking advantage of the expanded convention center for the Photonics West 2006 three-day exhibition, the total number of exhibitors will be nearly 1000, coupled with the Biomedical Optics weekend exhibition.

As part of the exhibition, SPIE will hold a two-day SPIEWorks Career Fair, where job seekers can network with recruiters, research employment opportunities, interview for positions, and post resumes online at spieworks.com.

Among the many special events at Photonics West 2006, one of the first of the week is the hugely popular BiOS Hot Topics session the evening of 21 January. Moderated by Sergio Fantini, Tufts University (Medford, MA), the event will feature presentations by Michael Berns, University of California at Irvine, on “Laser Microbeams in Space and Time;” Katarina Svanberg, Lund University Hospital (Lund, Sweden), on “Lasers and Spectroscopy in Medical Applications;” and Michael R. Hamblin, Harvard Medical School (Cambridge, MA), on “Low-Level Light Therapy: Progress and Possibilities;” among several others.

In addition, the workshop “Biophotonic Tools for Cell and Tissue Diagnostics,” hosted by the National Institute of Standards and Technology, will be open to the public. The workshop will identify the critical measurement needs for biophotonics tissue and cell diagnostics, generating a statement of needs to be incorporated as part of the national assessment of the U.S. Measurement System infrastructure.

For more about these and the many other events at Photonics West 2006, visit spie.org/events/pw.

Applicants Sought for Congressional Fellowship Program

Optics and photonics professionals are invited to apply for the 2006–07 Congressional Fellowship Program, a joint endeavor by SPIE and the Optical Society of America (OSA).

The congressional fellow works for a one-year term, which runs September through August, in the office of a U.S. senator or representative, or with a congressional committee to gain first-hand knowledge of congressional operations, contribute to the policymaking process, and forge links among the engineering, scientific, and public policy communities.

“The congressional fellowship offered me the perfect opportunity to work directly on issues that are close to my heart and to give back to the science community and country that have nurtured me throughout my life,” says 2003–04 Congressional Fellow Elka Koehler.

Applicants are evaluated on technical competence, work experience, ability to serve in a public environment, and evidence of service to SPIE, OSA, and the optics and photonics communities. Applications are due by 31 January 2006.

For more details are available at spie.org/Announcements/06_07_Fellow.pdf.
SPIE members are integral to all aspects of the Society, including SPIE Press, a key publishing arm of SPIE. Featured here are books coming out this quarter written or edited by SPIE members.

For more information or to order any of these books, visit bookstore.spie.org.

**Nanocrystals**

Frank W. Wise is the editor of the upcoming Milestone Series volume *Selected Papers on Semiconductor Quantum Dots*.

Semiconductor quantum dots, also known as “nanocrystals,” are structures with electronic and optical properties that can be engineered through the size of the structure, not just the composition. Quantum confinement of charge carriers leads to a wide range of intriguing physical and chemical phenomena, and is a new degree of freedom in material design. Semiconductor quantum dots have potential for applications ranging from opto-electronic devices to biological imaging.

The papers selected for this volume cover the fundamental properties of semiconductor quantum dots and form a significant part of the foundation upon which the current field of nanoscience research has been built.

**Extreme UV**

For a comprehensive look at extreme UV (EUV) source technology, check out *EUV Sources for Lithography*, edited by Vivek Bakshi, a senior technical staff member at SEMATECH. This authoritative reference book on EUV source technology contains 38 chapters contributed by leading researchers and suppliers in the EUV source field.

Topics range from a state-of-the-art overview and in-depth explanation of EUV source requirements, to fundamental atomic data and theoretical models of EUV sources based on discharge-produced plasmas (DPPs) and laser-produced plasmas (LPPs), to a description of prominent DPP and LPP designs, and other technologies for producing EUV radiation.

Additional topics include EUV source metrology and components (collectors, electrodes), debris mitigation, and mechanisms of component erosion in EUV sources. The volume is intended to meet the needs of both practitioners of the technology and readers seeking an introduction to the subject.

**BioMEMS**

Steven S. Saliterman is the author of the new monograph *Fundamentals of BioMEMS and Medical Microdevices*.

BioMEMS devices are as important to the future of medicine as microprocessors were to the computer revolution at the end of the last century. BioMEMS is a science that includes more than simply finding biomedical applications for micro-electromechanical systems devices. It represents an expansion into a host of new polymer materials, microfluidic physics, surface chemistries and their modification, “soft” fabrication techniques, biocompatibility, and cost-effective solutions to biomedical problems.

It brings together the creative talents of electrical, mechanical, optical, and chemical engineers; materials specialists; clinical laboratory scientists; and physicians. BioMEMS devices are the platform upon which nanomedicine will be delivered.

Based on the author’s course on bioMEMS at the University of Minnesota, this book is an introduction to the science and a survey of the state of the art. Topics include microfabrication of silicon, glass, and polymer devices; microfluidics and electrokinetics; sensors, actuators, and drug delivery systems; micro-total-analysis systems and lab-on-a-chip devices; detection and measuring systems; genomics, proteomics, DNA, and protein microarrays; emerging applications in medicine, research, and homeland security; and packaging, biocompatibility, and ISO 10993 testing.

**Biomedical**

SPIE Fellow Valery V. Tuchin has written another must-have book for those in the biomedical field. *Optical Clearing of Tissues and Blood* describes an optical clearing method based on reversible reduction of tissue scattering due to refractive index matching of scatterers and ground matter. This technique, which has been of great interest for research and application in the last decade, is promising for future developments in the fields of tissue imaging, spectroscopy, phototherapy, and laser surgery.
A Chapter on the Go

The International School of Photonics SPIE Student Chapter is young but ambitious.

Founded just less than a year ago, the International School of Photonics SPIE Student Chapter at Conchin University of Science & Technology in Kerala, India, looks toward the future with enthusiasm as the chapter’s calendar fills with many events and activities. Although it had a record 91 members in its inaugural year, chapter leaders hope to entice even more new members with its full schedule.

Chapter President Jijo Ulahannan says the chapter has “three mutually supporting outlooks: academic, professional, and social.” The officers and chapter advisor V.P.N. Nampoori plan activities to encompass all aspects of the chapter mission.

Lectures by leaders in photonics play an important role in chapter activities. Building its foundation from the 2004–2005 school year, the chapter will continue to host invited lectures, research seminars, and special lecture series on various topics—with one important addition. With the support of SPIE’s Visiting Lecturer Program, SPIE Fellow Virendra N. Mahajan will speak at the school in January.

The chapter will also continue its “Rendezvous with Industry” program. The school hosts scientists and entrepreneurs from industry who share their ideas and work with the students to introduce them to research in the working world. Chapter Vice-President Rajesh M. Nair thinks this program is especially important to the chapter, as “students of the school get a great opportunity to interact with experts from optics and related industries, which will help them to become future entrepreneurs.”

In the professional realm, the chapter organizes training sessions and workshops for students, and gives career guidance including job placement support. Jijo says that “on the professional front, the chapter’s motto is to be a professional before you graduate.” This year they organized study tours and industry visits and will arrange more tours for the coming year.

Chapter members also meet for social activities. The group hosts community outreach such as open house events at the university and in their lab. “As future scientists and engineers,” Nair says, “we have certain obligations to the society in which we live.” This is why the social aspect of the chapter’s mission is so important to its members, he says.

The students’ biggest community outreach project is the “Optics and Photonics to School” program, which they organize with schools and colleges within the state. There they teach the fundamentals of physics and developments in optics to students in hopes of peaking interest in their field. Activities such as this event, “help students achieve hands-on experience of technical applications of what they learn,” Jijo explains. This type of work is very important to the chapter as it “enables the students to give back rich dividends to the society they are from,” Jijo says. To meet this goal, they also have organized a school-wide blood drive.

Members actively participate in conferences as well. Many members will attend Plasma 2005, a conference for plasma scientists held at the university in December.

The student members of the International School of Photonics have much to anticipate in the coming year. Jijo is most excited to take part in Spectra 2005 coming up this month at the university involving students from all over the country. The event combines both recreational and educational events, and includes a quiz competition, project design contests, and a cultural night. Jijo says this is an annual meeting of “students in a festive mood, but with a scientific outlook,” a phrase that could be used to describe the entire chapter.
The Institute for Roentgen Optics (IRO) was formed in 1991 as a public international organization headquartered in Lausanne, Switzerland. At the time, the work being performed on polycapillary optics by SPIE Member Muradin Kumakhov’s laboratory at the Kurchatov Institute of Atomic Energy was the basis for the new institute. In addition to leading scientists from the Kurchatov Institute, graduates from Moscow State University joined the IRO.

Since its formation, the institute has been a world leader in capillary x-ray optics, from the early days of x-ray lenses made of single capillaries to current research involving portable x-ray instrumentation for both industry and medicine.

Institute Origins
The idea of controlling the beams of neutral particles, x-rays, and neutrons was first proposed in the late 1980s by Kumakhov. Founded on using multiple reflection and special geometry of reflecting surfaces inside hollow glass capillaries, the idea was patented by Kumakhov in 1984.

The first x-ray capillary lens was created in his laboratory at the Kurchatov Institute of Atomic Energy in 1985, and the first neutron lens in 1987. Beginning in 1991, polycapillary optics have been the focus of research at the IRO.

In fact, several generations of x-ray lenses have been developed at the IRO. The first lenses were assembled manually using several thousand single capillaries with channel diameters of about 1 mm. Compare this to the most recent generation of lenses, made up of as many as a million channels, each channel less than 1 µm in diameter. The range of energy controllable with the help of Kumakhov polycapillary optics varies from hundreds of electrons to 60 keV. The optics have a very large angle of capture (6 to 10°) and transmit radiation efficiently from the source, concurrently converting the radiation into a quasi-parallel or focused beam. Lens length ranges from several millimeters to 12 cm, depending on the task at hand.

The IRO was also the first to produce polycapillary structures with nanometer-dimension channel sizes and the first to create neutron polycapillary lenses that are used efficiently to focus neutron beams.

Full X-ray Toolbox
The IRO not only has developed and manufactured high-performance optics but also has produced a new generation of micro-focus x-ray sources readily compatible with x-ray
optics, including various x-ray tubes with different purposes and generators.

In addition, IRO-manufactured linear position-sensitive detectors are used in IRO-developed diffractometers, the spatial resolution of which is better than 50 µm. The IRO is the only organization in Russia manufacturing the full range of x-ray tools.

On the basis of Kumakhov polycapillary optics, the IRO, in cooperation with Unisantis S.A. (Switzerland), has created a new generation of x-ray analytical equipment, constituting more than 15 different instruments.

X-ray spectrometers have been made for local fluorescence microanalysis of the chemical composition of objects (µ-XRF). In these instruments, the focal spot of the polycapillary lens varies from 10 µm and greater. In 2006, for the first time, a portable x-ray scanning microscope with a focal spot of 1 µm will be available commercially.

X-ray diffractometers for phase and stress analysis also have been created. Now one instrument combines chemical analysis (µ-XRF), phase analysis, and stress analysis. IRO stress analyzers are used for monitoring and routine checks of nuclear power plants, in aviation, and on railways.

All of these instruments have low power consumption (5 to 50 W) and small dimensions, and are lightweight (about 10 kg or less). The instruments can be operated in the field, in a standard lab environment, and even in a car—offering potentially real-time identification for homeland security.

Desktop Engineering

For the first time in x-ray engineering, a desktop instrument has been produced featuring record detection-level parameters. This instrument can analyze solutions, water, etc., at 1 ppb (i.e., 1/10¹⁰).

An x-ray mini-laboratory has been designed at the IRO as well. It covers five different functions: reflectometry, refractometry, diffractometry, small-angle scattering, and µ-XRF. A desktop microscope also has been created for µ-XRF. This instrument may be in pharmacology.

All of these developments mean Kumakhov polycapillary optics have become a real tool not just for laboratories but also in industry and medicine.

For more information on polycapillary research from the IRO, see www.unisantis.com.

The IRO does more than conduct research, though. The institute also organizes the International Conference on X-Ray and Neutron Capillary Optics held in Russia every three years under the aegis of SPIE and the SPIE Russia Chapter.

In addition, the IRO received the 2002 SPIE Technology Achievement Award for “outstanding scientific and technological achievements in the development, fabrication, implementation, and reduction to practice of Kumakov x-ray and neutron capillary and polycapillary optics.”

IRO efforts were also recognized at the International Exhibition of Military and Police Equipment in 2004, where its micro-XRF analyzer, a very convenient instrument for practical forensic examinations, was awarded a prize.

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**Farewell continued from page 38**

allows the Society to think globally about photonics development but work efficiently locally. This direction has been represented by such events as the International Congress on Optics and Optoelectronics in Warsaw, development of the Photonics Europe Symposium as the European Union dissemination platform, and the extraordinary promotional and educational activities performed by SPIE student chapters.

I have thoroughly enjoyed meeting with each and every individual this year, as well as with representatives of local optical organizations and companies. I particularly enjoyed my visits with the student chapters. I am proud that during my presidential year 20 student chapters have been approved and, especially, that I was able to help in initiating student chapters in such countries as India and Mexico. I believe that being the SPIE President who is “the girl from Eastern Europe” gave me a unique perspective to show people that our Society is truly international and open for all the world’s optics and photonics communities.

During this year I also had the pleasure to work closely with the wonderful SPIE staff, without whose efforts most of the Society’s activities would not be possible. The Society is strong through the work and devotion of its volunteers and staff, and I would like to thank both groups for their constant effort to grow and improve the Society.

Thank you again for giving me the invaluable opportunity to serve as your President during this unforgettable 50th anniversary year of SPIE.
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