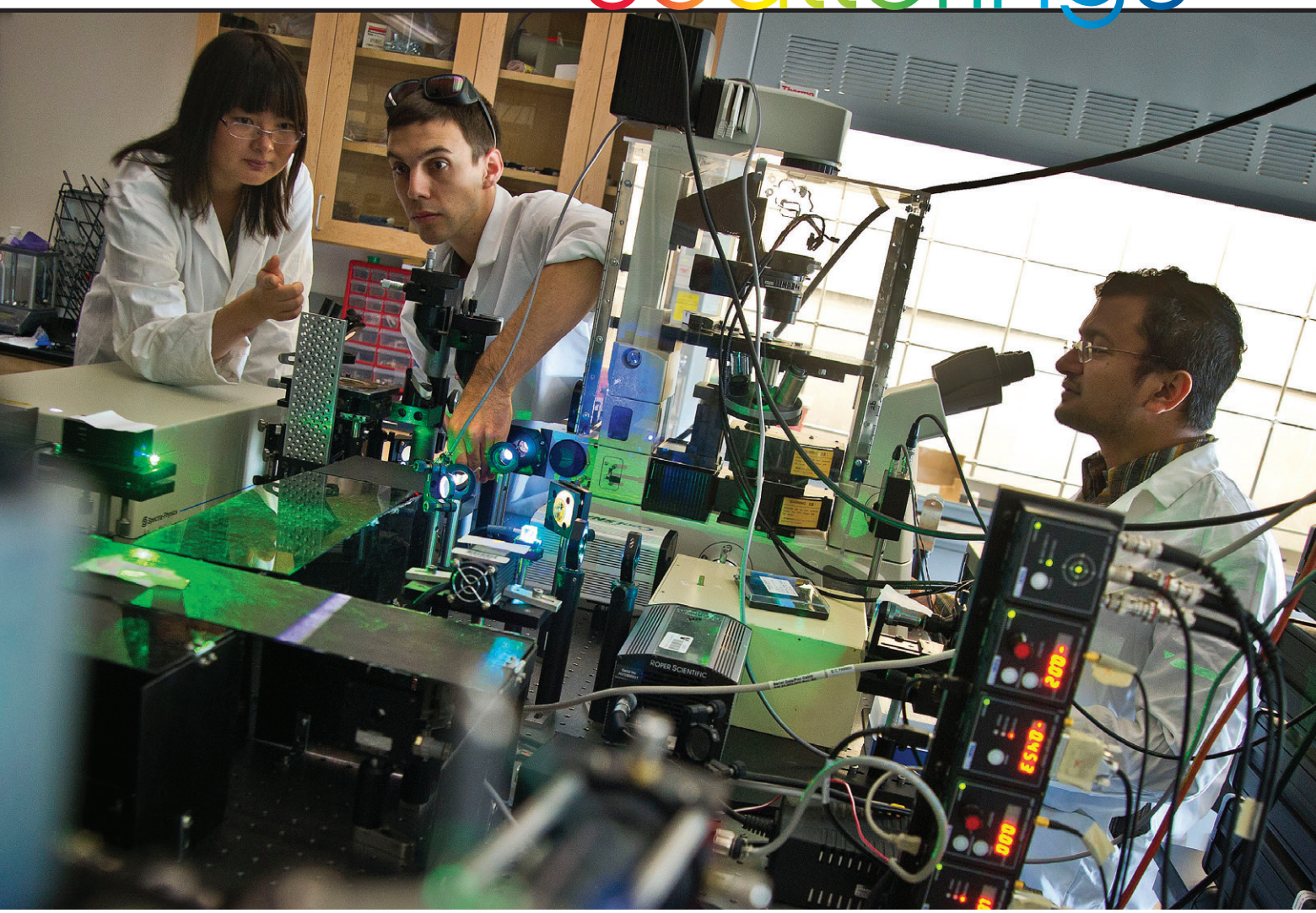


Mohanty (right) and his team in the lab.

S. Mohanty/ UT Arlington

IMAGING

Better Brain Mapping

Researchers use a new optogenetic tool to study neurological circuits.

Physicists are developing a tool that could be used to map neurons and track their interactions in different areas of the brain using optogenetics. Samarendra Mohanty from the University of Texas at Arlington (U.S.A.) hopes that the technology will be useful in helping scientists to better understand how the brain responds to stimulation.

Mohanty and his colleagues developed a two-photon, fiber-optic optogenetic stimulator and tested it on human cells. Optogenetics incorporates tools from optics, virology and genetics to enable scientists to genetically modify neurons so that they respond to photons; researchers then literally shine light into the brains of animals in order to observe and control how neural circuits work. The ultimate goal is to create targeted treatment options for neurological conditions.

By using near-infrared light instead of electric pulses, the scientists will minimize the amount of damage to living tissue. The low-energy method also improves precision and enables deeper focus than blue or green light sources. Furthermore, the fiber-optic instruments provide a smaller footprint than previous methods that employed bulky microscopes.

The technology would be beneficial to U.S. President Barack Obama's Brain Research through Advancing Innovative Neurotechnologies (BRAIN) program, a recently proposed brain mapping initiative. BRAIN will earmark $100 million for government-funded research. — *Valerie C. Coffey*

LASERS

New Scottish World-Class **Laser Center**

The University of Strathclyde in Glasgow recently announced the opening of the Fraunhofer Centre for Applied Photonics (CAP). The research center is the new United Kingdom headquarters for Europe's largest contract research organization.

CAP provides laser research and development and other technologies for the security, health care, energy and transportation sectors. University leaders expect CAP to play a major role in Strathclyde's technology and innovation centre, which aims to transform the way academia, business and industry collaborate to find solutions to global challenges, create jobs and support the economy.

In addition to support from German-based Fraunhofer, the center was made possible by funding from the University of Strathclyde, Scottish Government, Scottish Enterprise and the Scottish Funding Council.

—Sarah Michaud

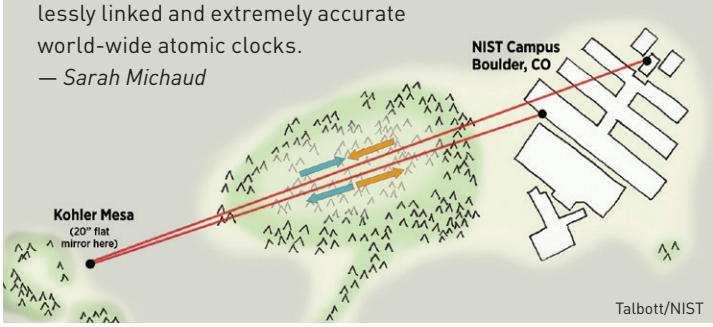
Royal College building, University of Strathclyde.

Wikimedia Commons

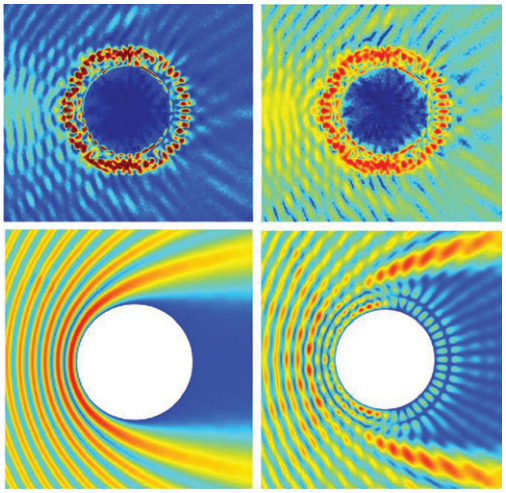
Tick Tock, Laser Clock

Researchers at the U.S. National Institute of Standards and Technology (NIST) have transferred ultraprecise time signals over a wireless optical channel with amazing precision. The technique involves bouncing laser pulses off a hillside mirror nearly two kilometers away from the lab through an open, outdoor space—the result is similar to the ticking of a next-generation atomic clock. The two-way signal transfer process manages signal timing distortions from atmospheric turbulence and opens the arena for wirelessly linked and extremely accurate world-wide atomic clocks.

— Sarah Michaud



Talbott/NIST



Optics Letters

MATERIALS SCIENCE

Printable Invisibility Cloak

Disk renders microwaves nearly undetectable.

The Harry Potters of the future might be able to create their own invisibility cloaks with the nearest 3-D printer. Using polymer-based 3-D printing, researchers at Duke University (U.S.A.) fabricated a free-space cloaking disk that suppresses scattering from a conducting cylinder at microwave frequencies (Opt. Lett. **38**, 1606).

Like most innovations in transformation optics, the printed cloaking device works only at microwave frequencies in 2-D. However, the scientists say that, because the polymer has a relatively low dielectric constant and refractive index, the technique should scale well to optical frequencies.

The team used computer simulations to draw plans for a ring-shaped disk that would act as a cloak against 10-GHz microwaves. Then they printed a copy of the ring from acrylonitrile butadiene styrene, whose dielectric properties in the microwave X-band (8-12 GHz) they had already measured. By mapping the electric-field intensity of the dielectric ring as it surrounded a conducting cylinder, the researchers determined that it had only a negligible "shadow" in the 10-GHz beam.

— Patricia Daukantas

(Above) Electric field intensity distributions for a cloaked cylinder (top row) and an uncloaked cylinder (bottom row).

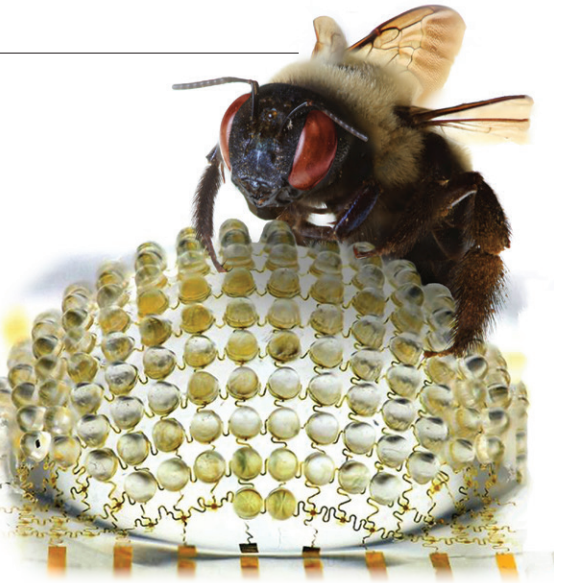
Over the past two decades, **optics and photonics** increased the capacity of the Internet by nearly **10,000-fold**.

A Bug's-Eye View

Scientists have developed a multilens imager that replicates the compound eyes of many insects. The researchers created the artificial "fly's eye" using flexible materials and a novel fabrication technique. The resulting camera offers a wide field of view, low aberration, nearly infinite depth of field and the ability to perceive motion, which may find use in surveillance cameras and endoscopes (Nature **497**, 95).

For electrical and optical materials, forming rounded shapes can place immense mechanical strain on a system, which is why multilens systems have traditionally consisted of arrayed planar surfaces. To gain the benefits of bug-like multilens eyes, the team had to think flexible.

They used polydimethylsiloxane (PDMS), a soft, transparent polymer, to form the microlenses. Each one is supported by a separate base and connected with a thin membrane also made of PDMS. Silicon photodetectors held within each lenslet are connected by flexible, serpentine wires. The researchers used a pneumatic system to induce the flexible array, electronics and all, into a hemispheric shape. — *Lynn Savage*



The "compound eye" digital camera lens.

University of Illinois and Beckman Institute

Laser pioneer **Charles Townes** celebrates his **98th** birthday on 28 July.

tweeted

@DrMRFrancis (Matthew R. Francis)

I had some real thoughts brewing in my head, but they've all been replaced by "Build Me Up, Buttercup."

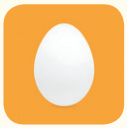
@jonmbutterworth (Jon Butterworth)

Why did the proton not stick to the menu? Because it didn't have a pion. #geekjoke

@Cmdr_Hadfield (Chris Hadfield)

Good Morning, Earth! We use Julian dates onboard, and thus it is the 100th day of 2013. Time sure flies at 8 km/sec!

@SassyScientista (Sassy Scientista)



"Equipment A was used instead of Equipment B, because I would have to talk to someone difficult each time I used B." #overlyhonestmethods

@AstroKatie (Katie Mack)

As of a few minutes ago, there are now 6 people living in space — three Russians, two Americans & one Italian. Cooperative exploration FTW.*

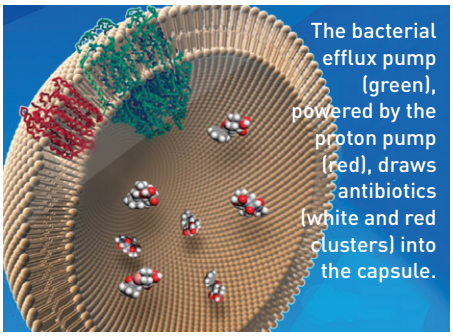
*FTW=for the win

SOLAR

Solar-Powered Nanocapsules Filter Water

A team from the University of Cincinnati (U.S.A.) has developed a solar-powered filtering nanocapsule that could reduce the amount of antibiotic runoff into lakes and rivers (Nano. Lett. **13**, 2189). Antibiotics found in our waste water can wreak havoc on aquatic environments and our water supply by encouraging the emergence of antibiotic-resistant bacteria and by harming beneficial microbes. This new technology is nearly twice as effective as activated carbon in removing these pollutants.

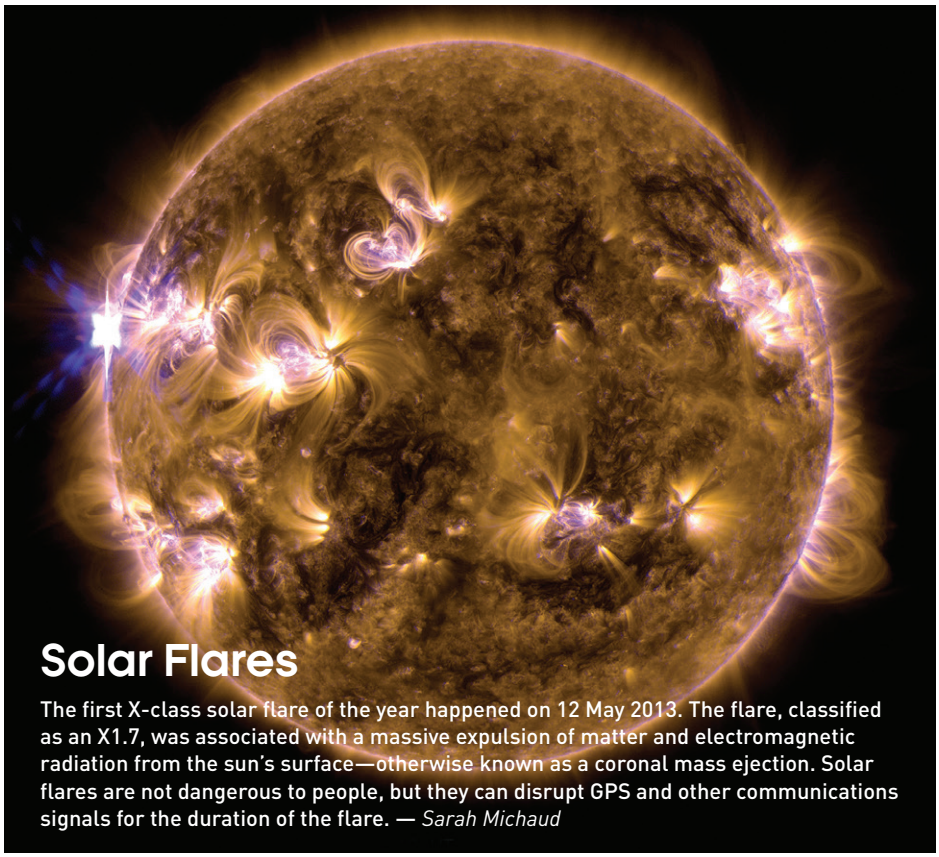
The team took a bacterial efflux pump—a structure that expels antibiotics and other unwanted materials from inside the cell—and flipped it so that antibiotics are pumped into the engineered capsule.



The bacterial efflux pump (green), powered by the proton pump (red), draws antibiotics (white and red clusters) into the capsule.

American Chemical Society

The efflux pump is powered by a light-driven proton pump in the membrate. Once encapsulated, the antibiotics are rendered harmless and can be easily collected for disposal. The researchers believe this technology could be modified to remove hormones and heavy metals from water. — *Sarah Michaud*



Solar Flares

The first X-class solar flare of the year happened on 12 May 2013. The flare, classified as an X1.7, was associated with a massive expulsion of matter and electromagnetic radiation from the sun's surface—otherwise known as a coronal mass ejection. Solar flares are not dangerous to people, but they can disrupt GPS and other communications signals for the duration of the flare. — *Sarah Michaud*

NASA/SDO

POLICY

Europe Releases **Photonics Roadmap**

At this year's Photonics21 meeting in April, members presented the "Photonics Multiannual Strategic Roadmap Towards 2020 – Photonics Driving Economic Growth in Europe" to Neelie Kroes, Vice-President of the European Commission. The roadmap was developed by the European photonics community and outlines the research and innovation priorities through 2020.

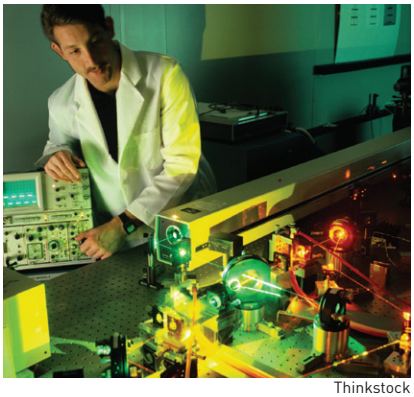
The roadmap paves the way to increase European photonics manufacturing and create more high-skilled employment opportunities. The document estimates that the compound annual growth rate for photonics will be 8 percent over the coming years, with the area of green photonics possibly seeing the highest growth at 20 percent. The proposed Photonics Public Private Partnership (PPP) will more closely align industry and public strategies, and will combine academic, industry and public resources for the knowledge base and funds necessary to reach their goals. In support of the PPP, the European photonics industry has committed to an investment of €7 billion—€5.6 billion from the private sector and the remaining €1.4 billion from the European Commission.

OSA CEO Liz Rogan and senior science advisor Anne Matsuura attended this year's event in Brussels, Belgium. The full report can be accessed at www.photonics21.org.

U.S. Launches National Photonics Initiative

The U.S. National Photonics Initiative (NPI) was launched on 23 May to unite experts in industry, academia and government to identify and advance areas of photonics critical to saving lives, improving the economy, creating jobs and sparking innovation for future generations. Over 100 experts from industry, academia and government worked together to identify the following areas as high-priority: advanced manufacturing, health care and medicine, defense and national security, information technology and communications and energy. The initiative is being led by OSA, the American Physical Society, the IEEE Photonics Society, the Laser Institute of America, SPIE and the International Society of Optics and Photonics. NPI's goals are to:

- Raise awareness about photonics and the impact of photonics on our everyday lives;
- Increase collaboration and coordination among U.S. industry, government and academia to advance photonics-driven fields; and
- Drive U.S. funding and investment in areas of photonics critical to maintaining U.S. competitiveness and national security.



Thinkstock

Creating the NPI is one of the key recommendations in the 2012 U.S. National Academy of Sciences report, "Optics and Photonics: Essential Technologies for our Nation." Visit www.lightourfuture.org for more information about NPI.

INDUSTRY

Photovoltaic Market: Down in 2014, Rebound in 2015

The solar photovoltaic (PV) industry is expected to continue its sluggishness in module revenues through 2013 and 2014, but will resume growth starting in 2015, according to the 2013 NPD Solarbuzz Marketbuzz report. The report predicts that module supplier revenues will decline 20 percent from $25.5 billion in 2012 to $20.5 billion in 2013. Module revenues are expected to be stronger in 2015, reaching $32 billion by 2017.

The solar PV industry experienced a sharp decline in 2012, in part due to the reduction in incentive schemes and government feed-in-tariff programs. As end-market demand tapered, companies that continued to ramp up inventory were left with overstock, driving average selling prices down. This mismatch placed extreme pressure on the solar PV manufacturing sector, which had expanded its capacity during 2010 and 2011 to potentially supply 45 GW to an end-market that reached only 29 GW in 2012. — *Valerie C. Coffey*

Global Photonics Growth Predicted through 2020

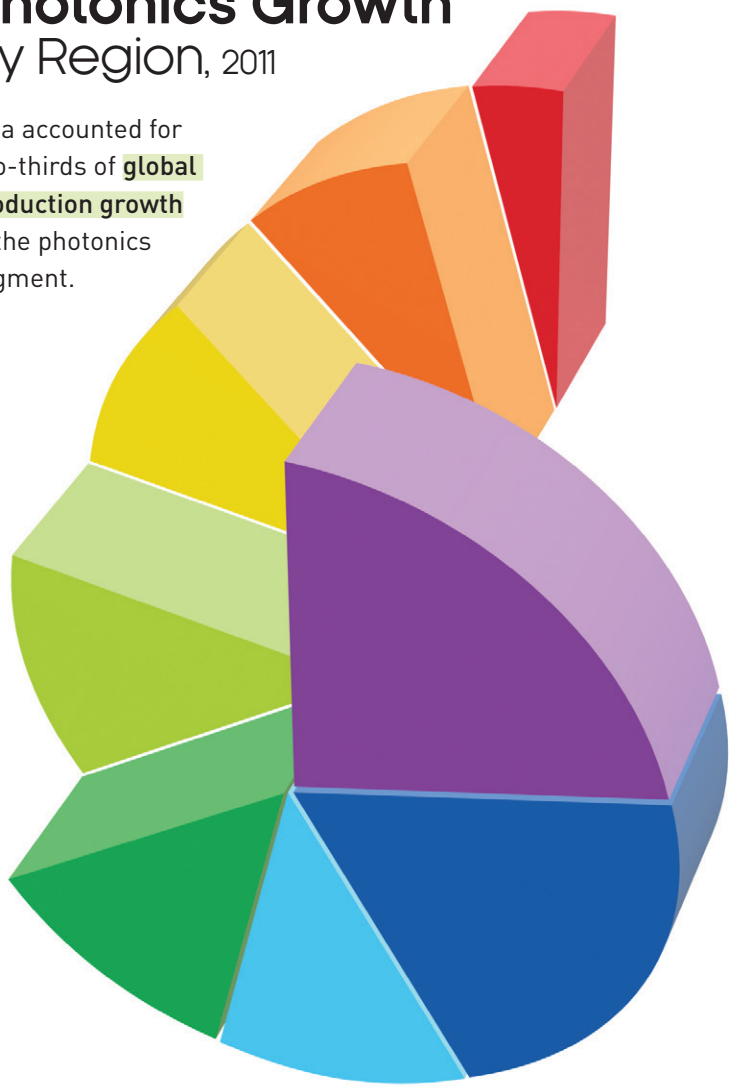
A new "Photonics Industry Report 2013" presented by four German industry associations predicts that the global photonics market will grow from €350 billion in 2011 to €615 billion by 2020. The forecast for photonics assumes compound annual growth of 6.5 percent per year, as reflected in the industry since 2005—a rate twice that of the worldwide gross domestic product over a period of severe economic downturn.

The report, available at www.vdma.org, was jointly announced by the German Federal Ministry of Education and Research, VDMA, Spectaris and ZVEI at the LASER World of PHOTONICS conference in Munich, Germany, in May. — *Valerie C. Coffey*

LEDs could cut U.S. electricity usage for lighting in half by 2030.

Photonics Growth by Region, 2011

Asia accounted for two-thirds of **global production growth** in the photonics segment.



- CHINA 21%
- JAPAN 21%
- SOUTH KOREA 12%
- TAIWAN 12%
- NORTH AMERICA 12%
- EUROPE 10% (excluding Germany)
- GERMANY 8%
- REST OF THE WORLD 4%

Illustration by Alessia Kirkland/Source: BMBF, SPECTARIS, VDMA, ZVEI (pub.), 'Branchenreport Photonik 2013', Optech Consulting, Study 'Photonik 2013'.

Patricia Daukantas, Valerie C. Coffey and Lynn Savage are freelance science writers who specialize in optics and photonics. Sarah Michaud is OPN's associate editor.

BOOK REVIEWS

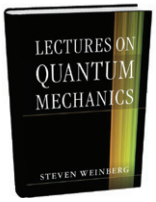
Animal Eyes, 2nd Edition

Michael F. Land and Dan-Eric Nilsson
Oxford University Press, 2012; $117.00 (hardcover).

This book blends biology and physics to explore the involvement of optics in the adaption of living organisms to their environment. The authors discuss several examples of how an animal's visual system has evolved to fit its environment based on optics principles. I highly recommend it to anyone, including amateurs, students and experienced researchers. — *Dejan Pantelić*

Lectures on Quantum Mechanics

Steven Weinberg
Cambridge University Press, 2012; $75.00 (hardcover).



Steven Weinberg has written an exceptionally clear and coherent graduate-level textbook on modern quantum mechanics. It presents the physical and mathematical formulations of the theory in a concise and rigorous manner. Although there are no figures in the book, there are useful indices and problem sets at the end of each chapter. — *Barry R. Masters*

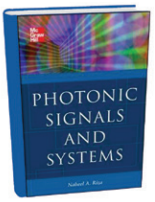
Nonlinear Fiber Optics, 5th Edition

Govind Agrawal
Academic Press, 2012; $119.95 (hardcover).

Nonlinear Fiber Optics is an exemplary publication designed for upper-level undergraduate and graduate courses in nonlinear optics, fiber optics or optical communications. The problems provided at the end of each chapter will be useful to course instructors. I would also recommend this book to engineers and scientists working in the fields of fiber optics and optical communications. — *Reva Garg*

Photonic Signals and Systems: An Introduction

Nabeel A. Riza
McGraw Hill, 2013; $125.00 (hardcover).



This excellent introductory textbook is a gateway to photonic engineering. It is written for undergraduates, but will also attract a wider readership interested in photonic design issues. In addition to the fundamental principles of optics for photonic systems, the author provides a solid grounding in optical components, micro-electronic-mechanical system devices, acousto-optic devices, liquid crystal and liquid devices. — *Axel Mainzer Koenig*

ONLINE EXTRA

Visit www.osa-opn.org for additional book reviews.

Reva Garg is a research associate at the Instituto de Física, Universidade de Brasilia, Brazil. Axel Mainzer Koenig is the CEO of 21st Century Data Analysis, a division of Koenig & Associates, Inc., Portland, Ore., U.S.A. Barry R. Masters is a Fellow of AAAS, OSA and SPIE. Dejan Pantelić is with the Institute of Physics, Zemun, Belgrade, Serbia.