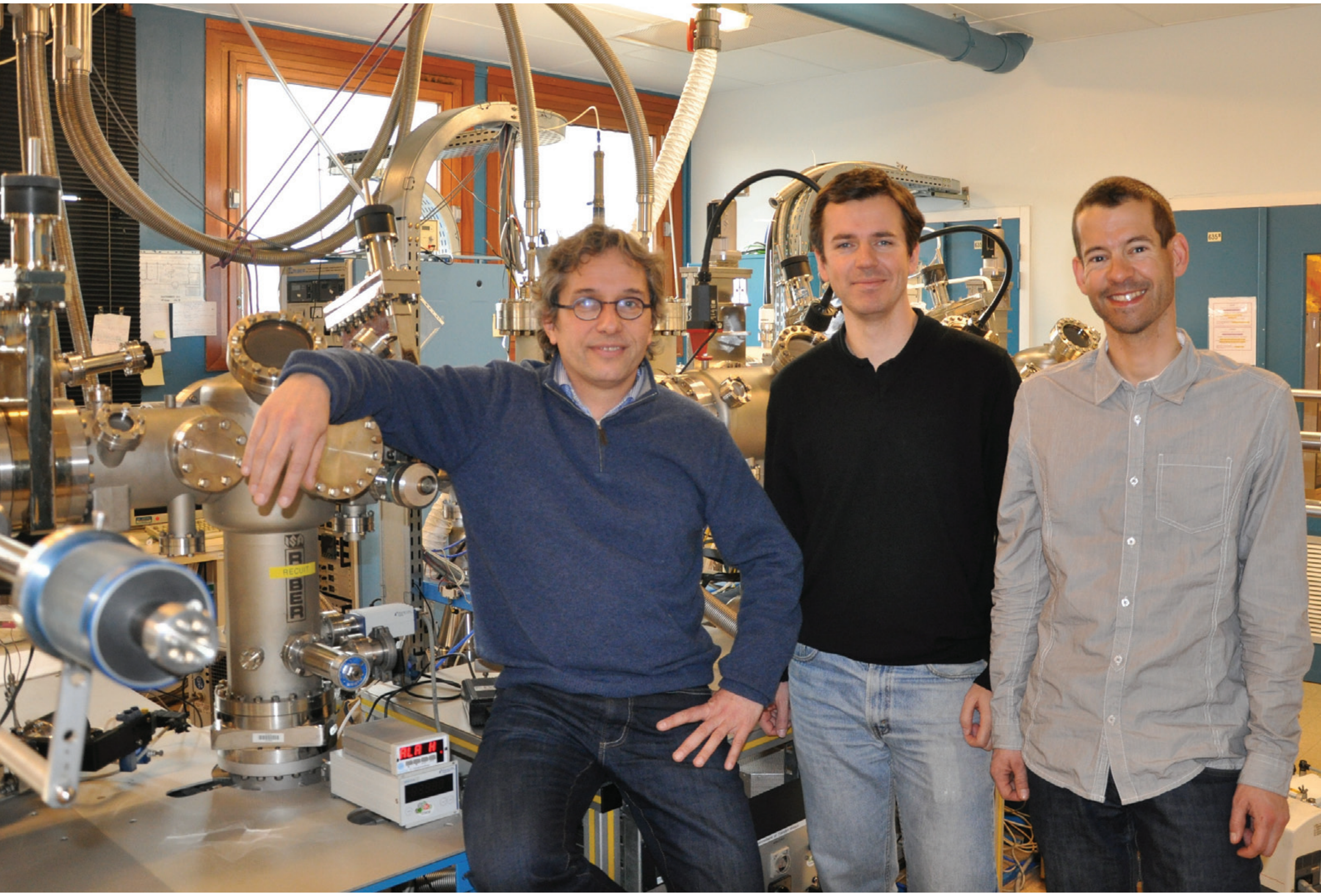
Institute for Nanoscience and Cryogenics, France



Co-authors (left to right): Jean Michel Gérard, Emmanuel Dupuy and Julien Claudon.

Terahertz Switching

Optical switch operates 350 times faster than its electronic counterpart.

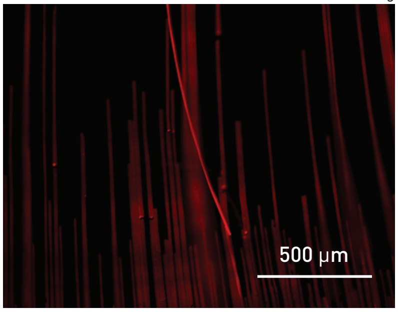
Scientists at the University of Twente (Netherlands) and the Institute for Nanoscience and Cryogenics (France) made a semiconductor planar microcavity switch on and off at a reproducible rate of 1.4 THz. In contrast, today's typical electronic switch operates at 4 GHz. This optical switch could speed up future telecommunications systems and even quantum computers (Opt. Lett. **38**, 374).

Emre Yüce, a junior scientist at Twente's MESA+ Institute for Nanotechnology, and his collaborators fabricated the cavity out of layers of gallium arsenide and aluminum arsenide and measured its resonance frequency at 1,284.1 nm. The team used two optical parametric amplifiers pumped by a near-infrared Ti:sapphire laser to shoot probe and trigger light beams into the tiny cavity.

The wavelength of the trigger beam was lengthened to 2,400 nm to reduce two-photon absorption. The cavity absorbed only about one millionth of the light input. The cavity storage time of roughly 300 fs determines the fundamental "speed limit" of the switching rate, according to the authors. The phenomenon is not dependent on the geometry of the microcavity.

Besides ultrafast on-chip photonic modulation, the new switch could find applications in fundamental studies of cavity quantum electrodynamics. —*Patricia Daukantas*

John Canning



Self-assembled silica microwires generated by an evaporative method.

Silica Microwire Self-Assembly

By controlling the shape of water droplets with a UV laser, researchers from Australia and France found a way to get silica nanoparticles to self-assemble into highly uniform wires as small as 100 μm in diameter (Opt. Mater. Express **3**, 284).

The ability to create microscale waveguides on surfaces that are not amenable to more common deposition and patterning methods could provide a way to integrate photonics onto many materials. It also offers a potential technique for functionalizing the waveguides to create active photonic devices.

The group from the University of Sydney (Australia) and Institut de Chimie Moléculaire et des Matériaux d'Orsay (France) used a 193-nm laser to both alter and pattern the surface properties of borosilicate slides. This enabled them to tune and control the contact angle of a water drop over the surface, which in turn allowed them to alter the self-assembly of nanoparticles into straight microwires that can be used as light guides. They created both straight and tapered waveguides. —*Yvonne Carts-Powell*

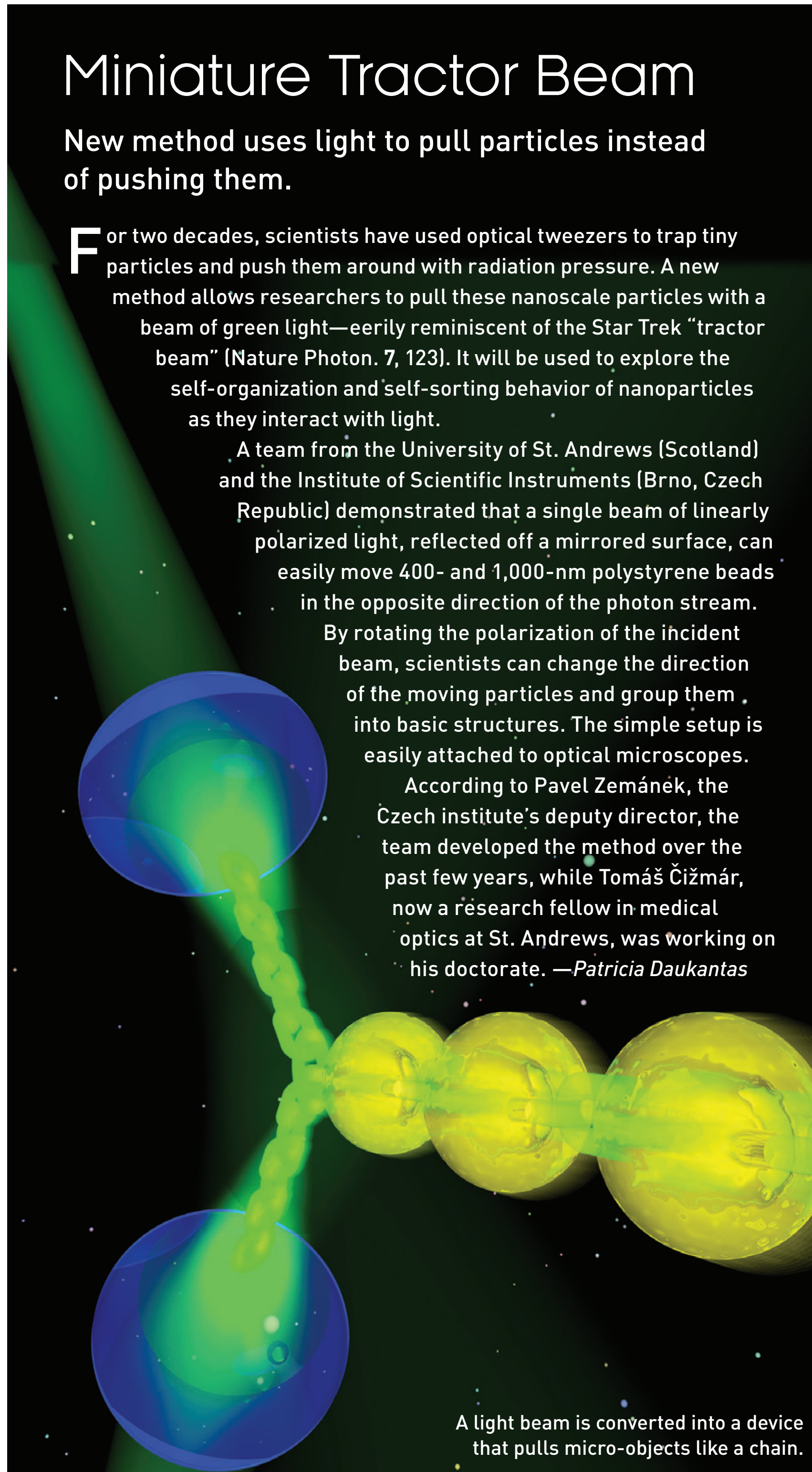
Miniature Tractor Beam

New method uses light to pull particles instead of pushing them.

For two decades, scientists have used optical tweezers to trap tiny particles and push them around with radiation pressure. A new method allows researchers to pull these nanoscale particles with a beam of green light—eerily reminiscent of the Star Trek "tractor beam" (Nature Photon. 7, 123). It will be used to explore the self-organization and self-sorting behavior of nanoparticles as they interact with light.

A team from the University of St. Andrews (Scotland) and the Institute of Scientific Instruments (Brno, Czech Republic) demonstrated that a single beam of linearly polarized light, reflected off a mirrored surface, can easily move 400- and 1,000-nm polystyrene beads in the opposite direction of the photon stream. By rotating the polarization of the incident beam, scientists can change the direction of the moving particles and group them into basic structures. The simple setup is easily attached to optical microscopes.

According to Pavel Zemánek, the Czech institute's deputy director, the team developed the method over the past few years, while Tomáš Čižmár, now a research fellow in medical optics at St. Andrews, was working on his doctorate. —*Patricia Daukantas*



A light beam is converted into a device that pulls micro-objects like a chain.

St. Andrews University, Scotland

A hard **X-ray nanoprobe** revealed that **Picasso** used common house paint for his masterpieces.

A person with **spectraphobia** has a fear of mirrors.

INDUSTRY

TOPTICA Acquires eagleyard Photonics

Laser manufacturer TOPTICA Photonics AG (Graefelfing/Munich, Germany) acquired the majority ownership of laser diode manufacturer eagleyard Photonics GmbH (Berlin). The acquisition is a strategic move to strengthen TOPTICA's diode laser business, expand eagleyard's product portfolio and extend many years of collaboration.

With annual revenue of about €4 million ($5 M USD), eagleyard specializes in high-power diode lasers with wavelengths ranging from 650 to 1,120 nm. The company will continue to operate independently with its own brand, sales and distribution. The laser diodes of eagleyard and TOPTICA are used in quantum optics, spectroscopy, medical technologies and other applications.
— *Valerie Coffey*

Courtesy of Gooch & Housego

Gooch & Housego headquarters in Ilminster, England.

Gooch & Housego Signs Switch Deal

Photonics components manufacturer Gooch & Housego (Ilminster, England) announced an agreement with Han's Laser (Shenzhen, China) to provide acousto-optic Q-switches for use in high-power laser systems. The three-year agreement will supply conduction-cooled Q-Switches for lasers destined for applications in materials processing, surgery, lithography and rapid prototyping. Neither company disclosed the value of the deal. — *Valerie Coffey*

IPG Photonics Changes Senior Management

Fiber laser company IPG Photonics Corporation (Oxford, Mass., U.S.A.) recently announced three changes to senior management designed to strengthen the company's global operations, sales and marketing. Trevor Ness, previously IPG's vice president of Asian operations, has been promoted to senior vice president, worldwide sales and marketing, and will continue to supervise the Asian operations. David Gray, previously chief strategy and new business officer at GT Advanced Technologies in Nashua, N.H., U.S.A., was appointed vice president, strategic development and systems solutions. Also Yuri Erokhin, previously IPG's senior director, strategic marketing, was promoted to vice president, strategic marketing.

Valentin Gapontsev, IPG Photonics' chief executive officer, gives the reasoning behind the changes. "Trevor Ness has been successful at IPG in establishing strong relationships with OEMs in Asia, as well as improving service and the effectiveness of the sales force there. David Gray has a proven track record of driving rapid growth through organic product development, strategic acquisitions and operational execution. Yuri Erokhin has a strong scientific background that he has applied to the development of sophisticated marketing strategies to identify and secure new business opportunities. We look forward to their combined contributions as we enhance our product portfolio, enter new applications and geographies and generate profitable long-term growth."
— *Valerie Coffey*

The National Ignition Facility in Livermore, Calif., U.S.A., is the world's largest laser, made up of **192 laser beams**.

Chu and OSA President Donna Strickland

OSA

POLICY

Chu Named Advocate of Optics

OSA presented its 2013 Advocate of Optics recognition to former U.S. Secretary of Energy Steven Chu. Chu was recognized at a reception as part of OSA's annual Winter Leadership Conference in Washington, D.C. He was chosen for his "public policy leadership and efforts in support of the advancement of the science of light," particularly his efforts in increasing investments for photovoltaics, LEDs and other optics-based energy technologies.

Chu is well known in the optics community for his Nobel Prize-winning work on laser cooling. An OSA Fellow and Honorary Member, he was appointed by U.S. President Obama as the Secretary of Energy in 2009 after an impressive career that included positions at Bell Labs, Stanford University, Lawrence Berkeley National Laboratory and the University of California, Berkeley.

He has been a vocal advocate for research into renewable energy. Under Chu's direction, the U.S. Department of Energy's SunShot Initiative has invested in more than 150 research, manufacturing, and market solution projects in photovoltaics, concentrating solar power, and systems integration.

Si LEDs Shine Bright from Red to Yellow

Lead author Florian Maier-Flaig reported silicon-based LEDs whose color depends on the size of the nanoparticles.

KIT

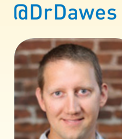
Researchers at Karlsruhe Institute of Technology (KIT, Germany) and the University of Toronto (Canada) have built efficient LEDs based on silicon nanocrystals and organic materials that emit colors from red all the way to yellow (Nano Letters DOI: 10.1021/nl3038689). Moreover, they improve on previous nanocrystalline Si LED results by offering a longer life and less sensitivity to the applied drive voltage.

Hybrid quantum-dot LEDs give off bright colors from inorganic emitters with easy processing from spin-cast organic layers. Most research has been focused on the use of II-VI quantum dots, which are made using toxic and expensive materials such as cadmium selenide, cadmium sulfide or lead sulfide. However, silicon—the workhorse of microelectronics—is fairly benign, common and cheap.

The color emitted by the nanocrystals depends on their size. The researchers separated out the nanocrystals, ranging from 1 to 3 nm in diameter. This increases the lifetime of the devices by reducing short circuits from oversized particles. The LEDs produce photoluminescent quantum yields up to 43 percent. If the researchers can get silicon to emit over the rest of the visible spectrum, their work could offer a way to make large-area Si LEDs at low cost. — *Yvonne Carts-Powell*

tweeted

@DrMRFrancis (Matthew R. Francis) WIMP annihilation sounds like something the anti-bully people would crack down on, but it's just astroparticle physics.



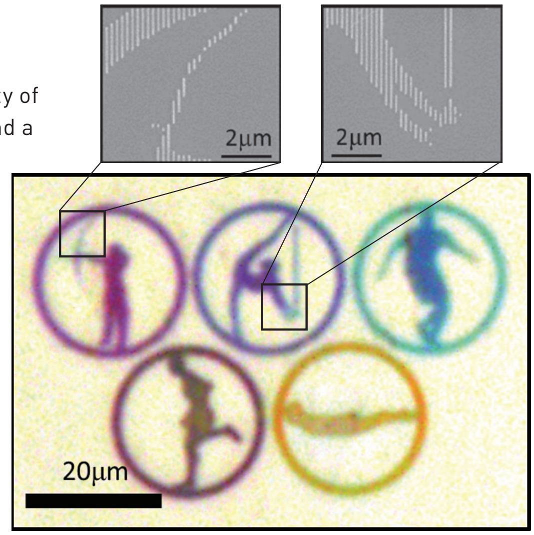
@DrDawes (Andrew M.C. Dawes) Psyched to get going on this research project; finally made progress installing our LN-cooled CCD. Let the photon-counting begin!

Bright Color, Low-Energy Displays

Researchers at the University of Michigan (U.S.A.) have found a way to lock in structural color using sub-wavelength structures (Scientific Reports **3**, 1194). If the technique can be developed further, it could be used with e-readers and other reflective displays, as well as for sensors and hyper-spectral imagers.

Diffraction gratings provide structural color, but the predominant color changes with viewing angle. Instead of using gratings on the order of the wavelengths, and on the surface of the material, the researchers went vertical. Group leader Jay Guo explains, "Light is funneled into the nanocavity, whose width is much, much smaller than the wavelength of the light." Surprisingly, the longer wavelengths of light get trapped in narrower grooves.

To demonstrate their device, the researchers etched nanoscale grooves in glass and coated the grooved plate with a thin layer of silver. When light hits the grooved surface, the transverse electric component creates a polarization charge at the metal slit surface, boosting the local electric field near the slit, which preferentially pulls in the transverse magnetic component of a particular wavelength of light.



Color is created by the width of the slits (black and white inset).

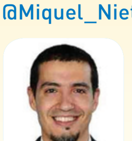
Jay Guo, U. Michigan College of Engineering

The demonstrated optical device has high absorption, as large as 96 percent in the visible spectrum, with colors that don't change over a ± 80-degree viewing angle. The device also demonstrated wide color tunability throughout the entire visible spectrum and pixel sizes smaller than the diffraction limit.

Right now, the new device can make static pictures. Even static displays, however, can be attractive with bright sunlight-visible color in low-energy-consumption reflective displays.

— *Yvonne Carts-Powell*

@Miquel_Nieto (Miquel Nieto) Revolution never stops in #physics. #science



@marckuchner (Marc Kuchner) Behold, ye science postdocs seeking jobs outside academia: social media profiles are the new resumes.

@Bill Gross (Bill Gross) "I never learned from a man who agreed with me." Robert Heinlein

Optics Letters, **38**, 317 (2013).

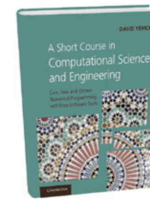
Progressive Optics Eliminates Blind Spots

A new optical prescription for side-view mirrors that uses progressive additive optics may eliminate the "blind spot" in traffic without distorting the perceived distance of cars approaching from behind. Objects viewed in a mirror using the design appear larger than they do in traditional mirrors, so it's easier to judge distance and speed. The technology is similar to that used in "no-line multifocal" eyeglasses that simultaneously correct myopia and presbyopia. These images illustrate the performance between a traditional aspheric mirror and a progressive mirror (top) and a traditional flat mirror and a progressive mirror (bottom).

BOOK REVIEWS

A Short Course in Computational Science and Engineering: C++, Java and Octave Numerical Programming with Free Software Tools

David Yevick
Cambridge University Press, 2012; $75.00 (hardcover).



The author has provided a very valuable, comprehensive reference for users of public domain key programming languages. Undergraduate and graduate students in the physical sciences and engineering as well as working scientists will benefit from this short course on computational science. It covers object-oriented programming and physical system modeling with a good foundation in numerical analysis.
— *Axel Mainzer Koenig*

ONLINE EXTRA

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

The Patent Truth

The National Science Foundation recently released the results of a survey of companies with R&D that reported U.S. patent applications in 2008. The companies most likely to report applications were from industries where patents are considered important to protecting IP, such as the semiconductor sector.

8.4 %	Food
9.7 %	Architectural, engineering and related services
13.0 %	Software publishers
18.0 %	Plastics and rubber products
21.1 %	All industries
29.3 %	Automobiles/bodies/trailers/parts
33.6 %	Pharmaceuticals and medicines
42.2 %	Electrical equipment, appliances and components
48.1 %	Semiconductor and other electronic components
62.8 %	Basic chemicals

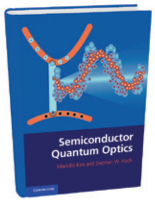
If you plan on filing a patent in the United States, it's important to note that, as of 16 March, the Leahy-Smith America Invents Act (AIA) is in effect. This act switches the U.S. patent system from a "first to invent" to a "first inventor to file" system. The overhaul brings the U.S. system closer to that of Europe. The main objectives of the AIA include: improving the quality of patents; aligning to international norms; determining rights early on in the application process; and reducing litigation costs and the risk of patent infringement. For more information, visit **www.uspto.gov**. —*Sarah Michaud*

Source: NSF/NCSES, BRDIS: 2008

Patricia Daukantas, Yvonne Carts-Powell and Valerie Coffey are freelance science writers who specialize in optics and photonics. Sarah Michaud is OPN's associate editor.

Semiconductor Quantum Optics

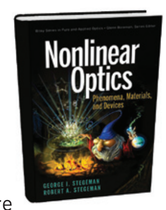
Mackillo Kira and Stephan W. Koch
Cambridge University Press, 2012; $90.00 (hardcover).



This lengthy book focuses on the applications of quantum optics to semiconductors. The text is very clearly written. Many of the formulas are explained in a step-by-step fashion. In addition, there are numerous exercises and recommendations for further reading at the end of most chapters. It is a useful tool for all those working in the quantum optics area of research.
— *Daniela Dragoman*

Nonlinear Optics: Phenomena, Materials and Devices

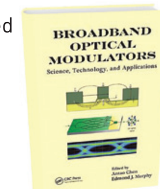
George I. Stegeman and Robert A. Stegeman
Wiley, 2012; $99.95 (hardcover).



Most of this volume is a logical exposition of useful formulas, many of which are taken from original publications. The most helpful elements are the tips and insights, often in numbered lists, about many of the topics. The authors present the material in an accessible way. — *George Fischer*

Broadband Optical Modulators: Science, Technology and Applications

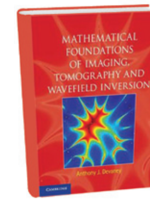
Antao Chen and Edmond J. Murphy, Eds.
CRC Press, 2011; $129.95 (hardcover).



The authors have produced a comprehensive reference with a concentration on broadband optical modulators. Graduate students and research scientists will benefit from this outstanding book. It offers newcomers a great introduction to the subject, with sections on fundamentals, modulator technologies and emerging applications.
— *Axel Mainzer Koenig*

Mathematical Foundations of Imaging, Tomography and Wavefield Inversion

Anthony J. Devaney
Cambridge University Press, 2012; $80.00 (hardcover).



This is an exemplary textbook about the theory of imaging based on the mathematical analysis of wave propagation. It is written for graduate students who are familiar with the theory of complex variables, Green-function techniques and linear algebra.

The text is augmented with clear illustrations, suggestions for further learning, problem sets, references and a useful index.
— *Barry R. Masters*

Daniela Dragoman is full professor on the faculty of physics at the University of Bucharest, Romania; George Fischer is with the U.S. ARMY, ARDEC, Picatinny Arsenal, New Jersey, U.S.A.; Axel Mainzer Koenig is CEO, 21st Century Data Analysis, a division of Koenig & Associates, Inc. Portland, Ore., U.S.A.; and Barry Masters is a Fellow of AAAS, OSA and SPIE. He is with the department of biological engineering at the Massachusetts Institute of Technology in Cambridge, Mass., U.S.A.