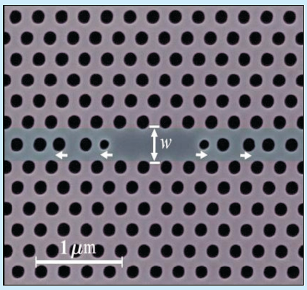
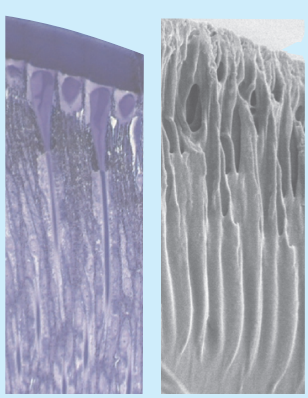
probes, among other things. (H. C. Kang et al., *Phys. Rev. Lett.* **96**, 127401, 2006.) —PFS

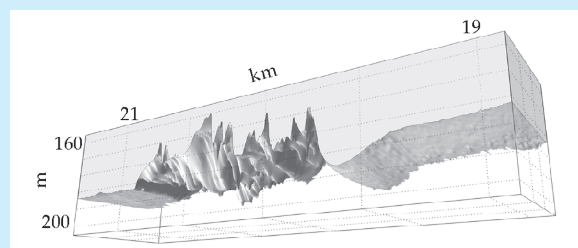
Minimalist laser in a photonic crystal. In the world of the very small, quantum dots (QDs) can behave like artificial atoms, able to emit and absorb photons at discrete frequencies based on an individual dot's energy levels. Like water drops on a waxed car, QDs can spontaneously form as tiny islands on a semiconductor substrate during epitaxial growth. Such dots interact strongly with lattice vibrations and can be greatly influenced by surfaces and the adjacent wetting layer. Researchers at the University of California, Santa Barbara, found a surprising benefit of those interactions when they buried some indium arsenide QDs in a photonic-crystal membrane—a thin sheet of gallium arsenide having a regular array of drilled air holes—that was missing a few holes, as shown in the electron micrograph. Only a few dots are in the defect area and yet they act as a gain medium to generate coherent laser light. How do they do it? The defect area is essentially an optical nanocavity within which the QDs interact, in effect tuning themselves to efficiently generate the stimulated emission of a laser. What's more, the laser has an exceedingly low lasing threshold. According to the researchers, the nanolasers are promising for future applications in integrated photonic circuits. For more on quantum dots, see articles in PHYSICS TODAY, May 2001, page 46, and October 2002, page 36. (S. Strauf et al., *Phys. Rev. Lett.* **96**, 127404, 2006.) —SGB



Artificial compound eyes. Unlike mammals, whose two eyes each have a single lens that focuses images onto the retina, insects and crustaceans have compound eyes: curved surfaces packed with tens to thousands of individual optical units called ommatidia. Each ommatidium consists of a faceted lens that focuses light through a crystalline cone onto a waveguide called a rhabdom, which is formed inside photoreceptor cells. Compound eyes are highly sensitive to motion and, because each ommatidium can view a different angle, a fused image from all the ommatidia can produce a very wide-angle, high-resolution image. A team led by Luke Lee at the University of California, Berkeley, has now succeeded in making artificial compound eyes. The researchers start with a spherical array of microlenses fabricated by molding a photosensitive polymer to a microtemplate. Next, the researchers make self-aligned waveguides behind the lenses by using a condenser lens to spherically illuminate the microlens array with UV light. The light causes the polymer behind each microlens to cross-link, producing the waveguide cores; subsequent baking completes the waveguides. As shown here, the artificial compound eye (right) is similar in structure to the honeybee's eye (left) and has comparable optical characteristics. The researchers envision a broad range of applications, including data storage and readout, medical diagnostics, and photography. (K.-H. Jeong et al., *Science* **312**, 557, 2006.) —RJF



Underneath an Antarctic ice shelf. Around much of Antarctica, the ice sheet extends out into the Southern Ocean to form floating ice shelves. Such shelves can be more than 1500 m thick and can have areas of several hundred thousand square kilometers. Interactions between the shelves and the water beneath them can have globally significant effects, since melted ice can cool and freshen the deep ocean waters. To learn more about the largely unexplored water cavities underneath ice shelves, a British team sent an autonomous underwater vehicle on a 53-km roundtrip excursion underneath the Fimbul Ice Shelf along the Princess Martha Coast. The researchers' analysis of the data they collected on the topography of the shelf base, the local current, and the water's temperature and salinity reveals a complex environment. Among their findings is that the base of the ice shelf—long assumed to be smooth, based on the shelf's surface features—shows regions of pronounced roughness, as seen in the figure. The team also concluded that the cavity under the shelf is exposed periodically to warmer, saltier water that could produce significant melting of the shelf's base. Team leader Keith Nicholls expects that similar missions will be undertaken to further explore the cavities beneath Antarctic ice shelves and to better understand the role the cavities play in Earth's climate system. (K. W. Nicholls et al., *Geophys. Res. Lett.* **33**, L08612, 2006.) —RJF



Surface acoustic waves (SAWs) can excite artificial molecules. A lithographically fabricated quantum dot allows electrons only a restricted menu of energies. The same is true for a pair of quantum dots 200 nm apart, and with just the right voltage applied, electrons can tunnel from one dot to the other. In fact, an electron, viewed as a spread-out quantum wave, can be considered to reside in both dots at the same time, a property that makes the quantum-dot "molecule" potentially useful for quantum computation (see PHYSICS TODAY, March 2006, page 16). Now, using SAWs excited in the substrate supporting a double quantum dot, a group of scientists has been able to probe and even change the dots' quantum energy states. The piezoelectrically generated waves, less than 1 nm in amplitude, ripple over the surface for hundreds of microns. The SAW–dot system can operate in both directions: The quantum dots can be used to monitor the acoustic waves, which because of their minuscule energy are otherwise difficult to detect; or the acoustic waves can be used to interrogate the electronic status of the dots, which makes possible quantum information applications. The researchers are at the University of Twente and the Delft University of Technology in the Netherlands; NTT Corporation, the Tokyo Institute of Technology, and the University of Tokyo in Japan; and Jilin University in China. (W. J. M. Naber et al., *Phys. Rev. Lett.* **96**, 136807, 2006.) —PFS ■