Helium crystallization with sound waves. A pure liquid exposed to a powerful acoustic wave can "break" and produce bubbles (a process called cavitation) during the wave's negative pressure swing (see Physics Today, February 2000, page 29). That liquid–gas transition has been known for some time. Now, physicists at Ecole Normale Supérieure in Paris have observed an acoustically driven liquid–solid transition in He. They focused a short, powerful burst of 1-MHz ultrasound in a small region of liquid He near a clean glass plate and used a laser to monitor the He density at that spot. During the positive, overpressure swing of the ultrasound, they observed crystallites growing up to 15 μm in size—in a mere 150 ns—and an even-faster melting some 250 ns later when the negative pressure swing of the ultrasound wave passed through. The researchers argue that the crystallization process was pure: Nucleation took place at a clean wall but did not involve any impurities. Using a more powerful sound wave, they believe they can generate He crystals without the wall. (X. Chavanne, S. Balibar, F. Caupin, *Phys. Rev. Lett.* **86**, 5506, 2001) —PFS

Photodetectors from DNA. The large molecule deoxyguanosine (DG) is one of four basic units that encode genetic information in DNA. It also turns out to be a good semiconductor material in some experimental photodetectors. Researchers at the National Nanotechnology Laboratory of the National Institute for the Physics of Matter (INFM) in Italy fabricated their detectors by placing a tiny droplet of DG, dissolved in chloroform, at the juncture of two electrodes. As the chloroform evaporated, the DG molecules self-assembled into an array of 100-nm-long ribbons between the electrodes. The resulting DG-based photodetectors are roughly twice as sensitive to light as commercially available detectors. If the researchers can succeed in doubling the length of the DG ribbons to about a quarter of a micron, the chloroform solution could be deposited with a modified inkjet printer nozzle, while the rest of the device could be manufactured in a modern semiconductor lithography facility. The researchers point out that, ultimately, a multitude of electrical components could rely on a surprisingly small number of molecules. (R. Rinaldi et al., *Appl. Phys. Lett.* **78**, 3541, 2001.) —JRR

The proton's charge and magnetization have different spatial distributions, new experiments have found. It has long been known that the proton's electric charge and magnetic moment were each spread throughout the particle. The details, however, have remained unclear as to how the three quarks that make up the proton—and the gluons that hold those quarks together—interact to give the proton its electric and magnetic properties. In recent Jefferson Lab experiments, physicists fired an intense beam of polarized electrons at a target of liquid hydrogen and measured the degree of polarization transferred to the proton. The electrons' energies spanned 1000–5700 MeV and thereby probed features within the proton on various spatial resolutions, down to 10% of the proton's radius. The measurements showed that the electric charge is distributed over a larger volume in the proton than is the magnetization. Thus, the magnetic moment in all likelihood arises from a combination of the intrinsic spins of the quarks and gluons and the motions of the electrically charged quarks. Olivier Gayou, a graduate student at the College of William and Mary, reported the experimental results at the April meeting of the American Physical Society. —BPS

An electron beam can be refracted at the interface between a plasma and a gas, much as light is refracted at an air–water interface. A California-based research collaboration (University of Southern California, UCLA, and Stanford) used a beam from SLAC's Final Focus Test Facility, consisting of 20 billion electrons at 28.5 GeV in a bunch that was about 0.7 mm long and 40 μm in radius. As the electron beam passed through a long, thin "tube" of plasma, it first repelled plasma electrons, leaving the sluggish ions behind to form a positively charged channel, which focused the remaining electrons. As the beam left the plasma at a grazing incidence, the ion channel became asymmetric and the exiting beam was deflected by up to a milliradian. The researchers also showed that, at sufficiently small incident angles, the beam underwent total internal reflection. Thus, they envision magnet-free particle-storage rings or plasma-based wires, although such "plasma waveguides" may require a laser to preform the ion channel. (P. Muggli et al., *Nature* **411**, 43, 2001.) —BPS

Evidence of black hole rotation. An object in our galaxy called GRO J1655–40 consists of a seven-solar-mass black hole gradually devouring a nearby normal-star companion. Matter from the star first collects in an accretion disk orbiting the black hole before taking the final plunge through the event horizon, emitting x rays along the way. General relativity predicts the innermost stable orbit for matter circling this black hole, if it were nonrotating, to be about 64 km. However, at the April American Physical Society meeting, Tod Strohmayer of NASA's Goddard Space Flight Center reported the discovery of a 450-Hz oscillation from the black hole in archival data from the Rossi X-Ray Timing Explorer. This high frequency indicates matter is orbiting the black hole at a radius of only 49 km. Based on this finding, he concluded that the black hole itself must have angular momentum. (T. Strohmayer, *Astrophys. J.* **552**, L49, 2001.) —PFS