NANOSCOPIC ELECTROMAGNETIC FIELDS can now be directly imaged in real time, using only an electron holographic microscope (EHM). Conventional electron holography is a two-step—and therefore not real-time—process, requiring taking a hologram (step 1), then reconstructing the image (step 2). A previous real-time method combined an EHM and an optical reconstruction system, but proved difficult to implement. Now, researchers in Japan have passed three electron-wave beams, two of which are reference beams, through the electromagnetic field of interest (typically emanating from a small object) to record a "three-wave interference" pattern onto a film or CCD camera. The fringes alone contain little information, but their intensity modulations reveal lines of electric equipotential or magnetic flux. Applying their technique to a 0.5 μm electrically charged latex particle, the researchers deduced from the imaged field that it was created by about 400 electrons. They also imaged the weakening electric field of a charged insulating particle as its temperature was increased, and the dipole-like magnetic field of a single-domain particle of barium ferrite. (T. Hirayama *et al.*, *J. Appl. Phys.* **82**, 522, 1997.) —BPS

TRAPPING A SINGLE NANOPARTICLE between two electrodes can now be done in a straightforward way, offering possibilities such as single-nanoparticle switches. Researchers in The Netherlands constructed a circuit containing two platinum electrodes separated by as little as 4 nm—a gap that they narrowed from about 25 nm by sputtering the Pt. To trap molecules or clusters electrostatically, they then immersed the electrodes in a solution containing the nanoparticles, and applied a voltage to the circuit. The electric field between the electrodes polarized the particles and attracted them to the gap. When the gap was bridged, current flowed through the circuit, and a resistor then sharply reduced the electric field, discouraging additional nanoparticles from entering the gap. A single particle is all that's needed to span a small enough gap. In principle, this electrostatic-trapping technique can work for any polarizable nanoparticle; it has been demonstrated for 17 nm palladium clusters, micrometer-long carbon nanotubes and a 5 nm long chain of thiophene (a conducting polymer). The researchers have also studied the transport properties as single electrons tunnel into a Pd nanocluster between the electrodes. (A. Bezryadin, C. Dekker, G. Schmid, *Appl. Phys. Lett.* **71**, 1273, 1997.) —BPS

EARTH'S CRUST AND MANTLE might have slewed around quickly in the early Cambrian period, like an orange's skin coming loose from the fruit and slipping about. This hypothesis, advanced by Caltech geobiologist Joseph Kirschvink and his colleagues, is based on his study of the pattern of fossil magnetism in rock strata worldwide. The colossal slippage of the outer part of the Earth relative to the core, a process called true polar wander, would have arisen from the differently oriented moments of inertia in the two regions coming more into alignment. This slippage would have produced a rapid (in about 15 million years), global redistribution of surface topology, although the planet's spin axis would have remained fixed. During this newly postulated geodynamic event, the crustal plates, which today float along on top of the mantle at a stately pace of a few centimeters per year, would have raced along (as one unit with the mantle) at up to a meter per year. The ensuing grand trek could have rotated the continental landmasses by as much as 90°. All of this happened in a blink of the geological eye, according to Kirschvink, about 530 million years ago, and was thus simultaneous with, and might have influenced or caused, the "Cambrian explosion," the greatest evolutionary proliferation of diverse living organisms in our planet's history. (J. L. Kirschvink, R. L. Ripperdan, D. A. Evans, *Science* **277**, 541, 1997.) —PFS

QUARK MATTER IN NEUTRON STARS could be detectable. A typical neutron star is primarily composed of normal hadronic matter. In its dense, high-pressure core, however, the hadrons can undergo a phase transition in which they become deconfined into quark matter. This is the quark–gluon plasma state currently being sought at CERN in Geneva and (in the next few years) at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory. According to the Lawrence Berkeley National Laboratory's Norman Glendenning and his colleagues, because a rapidly spinning neutron star (pulsar) will gradually shed energy and angular momentum in the form of radio emissions and an electron–positron stellar wind, the star will become more spherical, with a corresponding rise in the central density, making conditions more favorable for the creation of quark matter. The era during which the quark core grows as the star spins down would be marked by a decreasing moment of inertia and an anomalous value for the "braking index," which would differ by an order of magnitude or more from the canonical value of 3. The deviation can be in either direction—the star might "spin up." Glendenning suggests that one in a hundred pulsars is undergoing the baryon-melting phase transition, so perhaps seven of the presently known pulsars could show the effect. (N. Glendenning, S. Pei, F. Weber, *Phys. Rev. Lett.* **79**, 1603, 1997.) —PFS ■