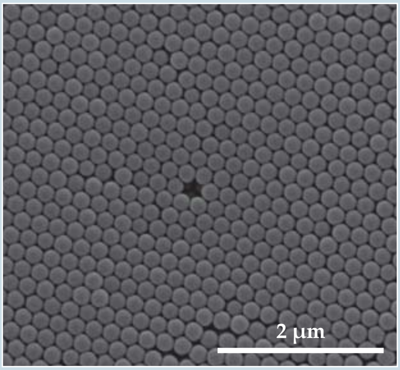
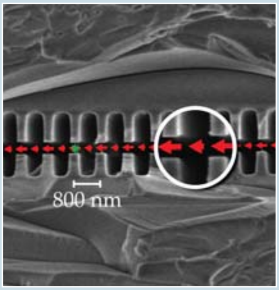
40 mm on a side, designed to resonantly couple to the magnetic field from incident microwaves at 900 MHz. The researchers integrated into the resonator additional circuit elements—capacitors and diodes—to harness and rectify the AC current induced in the loop. A metamaterial (shown in the figure) consisting of an array of five such resonators wired together achieved a power-conversion efficiency of 37%, in close agreement with the team's simulations. Since the collective response of the resonators can be finely engineered, the team expects that metamaterial power harvesters could find wider application than general antenna-based implementations. (A. M. Hawkes, A. R. Katko, S. A. Cummer, *Appl. Phys. Lett.* **103**, 163901, 2013.) —RJF

A gem of a breathalyzer. Among the dizzying assortment of chemical sensors are those based on photonic crystals—regular arrays of materials with different refractive indexes—with their well-defined physical properties and good sensitivity. Gem-quality opals are naturally occurring photonic crystals made of closely packed, tiny spheres of hydrated silica.



An opal's shimmering range of colors arises from the interference and diffraction of light passing through its microarrays. Synthetic opals made with nanospheres of silica or polystyrene and infiltrated with a chemically active hydrogel make for good, inexpensive chemical sensors; as the hydrogel reacts, it swells or shrinks, which changes the spacing of the crystal and thereby shifts the crystal's Bragg diffraction peak. A team of researchers at the University of Palermo in Italy has now engineered a hydrogel that swells to a baseline volume when infused with water vapor, and swells significantly more when ethanol vapor is present. What's more, when the hydrogel infiltrates a synthetic opal film (shown here), the additional swelling shifts the Bragg peak linearly with respect to the concentration of ethanol, producing a calibrated color change. As a bonus, the device can be reused many times just by letting the ethanol evaporate. The downside of the prototype device is that the full response took about 47 minutes. However, the researchers expect that removing the polystyrene will speed things up significantly, because then the spheres won't impede ethanol's diffusion. (R. Pernice et al., *Opt. Mater. Exp.* **3**, 1820, 2013.) —SGB

Particle acceleration on a chip. Researchers are working on various fronts to develop compact, inexpensive particle accelerators for medical imaging, security scanning, and more. One promising approach is dielectric laser acceleration (DLA), in which a laser field drives acceleration across a channel etched in a dielectric material. Now, in an experiment conducted by a team including Joel England (SLAC), Robert Byer (Stanford University), and Byer's graduate students Edgar Peralta and Ken Soong, DLA has successfully accelerated relativistic (60 MeV) electrons. The figure illustrates the group's



fused silica structure that, at full-size, can fit on a fingertip. Here's how it works. An 800-nm polarized laser field propagates through the device from top to bottom in the plane of the figure. The arrows in the figure represent the electric field at a particular instant of time; the important point is that in the vertically extended channel regions, the field amplitude is relatively small. The device's repetitions match the 800-nm laser wavelength. Thus, if a relativistic electron traversing the channel encounters an accelerating field at the starred location, it will encounter another accelerating field one period length and one laser oscillation later. On the way, it passes through a relatively weak decelerating region; on balance, the electron gains energy. In the actual experiment by England and company, some initially relativistic electrons were further accelerated while others were decelerated. But a sizable fraction received an energy boost of 60 keV or more. A team led by Peter Hommelhoff has recently reported that DLA can also accelerate nonrelativistic electrons. (E. A. Peralta et al., *Nature* **503**, 91, 2013; J. Breuer, P. Hommelhoff, *Phys. Rev. Lett.* **111**, 134803, 2013.) —SKB

El Niño intensifies and shifts seasonal storms. The frequency and intensity of winter and spring storms in North America are increasing. Climate change is the likely culprit, but the interannual climate disturbance known as El Niño might also be contributing to the upward trend. To see if that's the case, Xiangdong Zhang of the University of Alaska Fairbanks and his colleagues conducted a series of simulations using the National Center for Atmospheric Research's

community atmosphere model. Because Earth's weather is so sensitive to initial conditions, Zhang and his team ran 120 simulations in all, each beginning a little differently. Half included the elevated sea-surface temperatures off Ecuador that characterize El Niño. The other half didn't. After seven months of number crunching, the results are in. El Niño intensifies winter–spring storms and boosts their frequency in the northwestern, southeastern, and southwestern quadrants of North America. But in the northeastern quadrant, El Niño's main effect was to weaken winter storms. From the various parameters generated by the model, Zhang and his team identified the cause of that regional pattern. The largest nursery of storms was a concentration of atmospheric angular momentum that lay above the Aleutian Islands in the non–El Niño runs but moved south in the El Niño ones. El Niños are not caused by climate change. But if, as observations and simulations suggest, climate change is making El Niños stronger and more frequent, most of Canada and the US could be in for worse winter weather. (S. Basu et al., *Geophys. Res. Lett.* **40**, 5228, 2013.) —CD ■