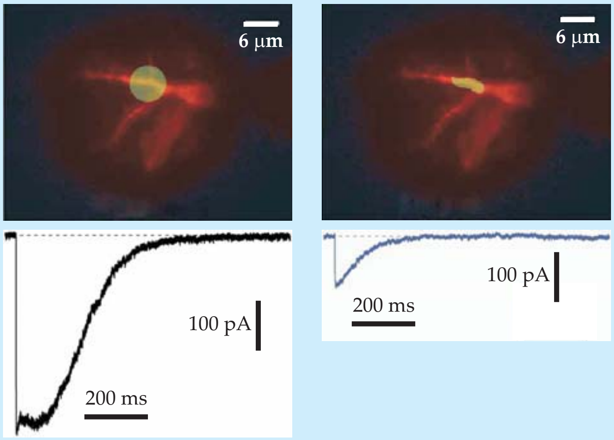
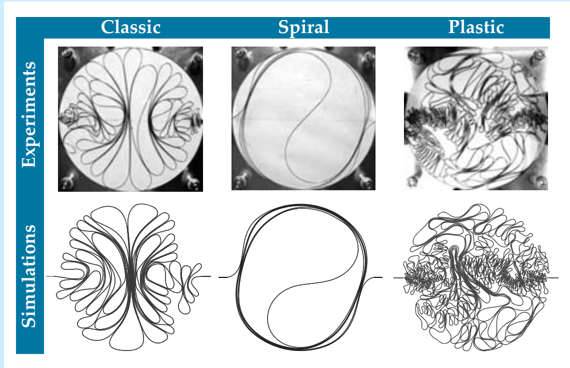


Descartes and her colleagues are now using LC-SLMs to create holographic illumination to selectively activate biological probes in specific locations. One such probe is glutamate, a major neurotransmitter, caged within a photoactive molecule. Shown here are data recorded from cells within a slice of mouse brain tissue perfused with caged glutamate and illuminated in the green regions with a 6-micron-diameter spot (left) and, in the same location, with a holographic shape that coincides with just the dendrite of interest (right). Plotted below each image are glutamate-stimulated currents resulting from brief light pulses. The responses show a large reduction in unwanted signal when the LC-SLM is used. The researchers also simultaneously activated several precisely positioned spots on the same neuron, demonstrating highly controlled stimulation of different neural inputs. (C. Lutz et al., *Nat. Meth.* **5**, 821, 2008.) —SGB

Coulomb four-body problem. The dynamics of a quantum system with four charged particles can be a tough nut to crack, and competing theoretical models often differ qualitatively in their predictions. Helium provides a good four-body system to study when an electron collides with the atom to knock out both native electrons and leave the doubly charged bare nucleus behind. Theorists have disagreed about the directions the three escaping electrons would take when the incoming projectile is near the threshold energy for such an electron-impact double ionization process. Alexander Dorn, Joachim Ullrich, and colleagues at the Max Planck Institute for Nuclear Physics in Heidelberg, Germany, have now measured the momenta of the three electrons in that very energy regime and have found that the electrons tend to emerge in an equilateral triangle shape, separated by angles of 120 degrees, as predicted by some theories. Interestingly, one of the successful theories—put forth by Agapi Emmanouilidou of the University of Massachusetts Amherst and her colleagues—predicts that the escape pattern depends on the initial bound-state configuration and that the electron paths for triply photoionized lithium would take a T-shape, with two electrons emerging back-to-back. (X. Ren, A. Dorn, J. Ullrich, *Phys. Rev. Lett.* **101**, 093201, 2008; A. Emmanouilidou, P. Wang, J. M. Rost, *Phys. Rev. Lett.* **100**, 063002, 2008.) —SGB

Morphological phases of crumpled wire. The loops and folds that result when a sheet, tape, or wire crumples are of practical and theoretical interest. Engineers want to predict how structures deform under stress; physicists want to reduce diverse crumpling behavior to a few simple principles. Toward that second aim, Norbert Stoop, Falk Wittel, and Hans Herrmann of ETH Zürich have conducted an experimental study of one elementary system: a length of metal wire stuffed from two opposing directions into a cylindrical container so shallow that the crumpling is two-dimensional. At the start of each run, the wire spanned the container in a straight line. Two counterrotating drums then pushed more and more of the wire into the container until, having bent to form a loop, the wire touched the side. What happened next, the researchers found, depended on the wire's elasticity and on the friction between the wire and the container. When friction is high, the wire adopted near-symmetric looping patterns, which the researchers termed classical. When friction is low and the wires are stiff and springy (the researchers used steel), the wire adopted spiral patterns. Floppy, soft wires (solder) adopted messy, asymmetric patterns, which the researchers termed plastic. By adjusting the elasticity and friction in their experiment, the researchers could delineate the three regimes in a morphological phase diagram. And, as the figure shows, they could reproduce the three phases with a simple continuum model. The ETH team anticipates their phase diagram could prove useful in characterizing the packing of DNA inside viral capsids and other crumpling systems. (N. Stoop, F. K. Wittel, H. J. Herrmann, *Phys. Rev. Lett.* **101**, 094101, 2008.) —CD



Highest-energy cosmic rays. The recently completed Pierre Auger cosmic-ray observatory in Argentina covers 3000 km^2 with ground detectors and fluorescence telescopes. Its purpose is to determine the distribution in energy, composition, and arrival direction of extragalactic cosmic rays with energies above 10^{18} eV. Seeking evidence of what accelerates cosmic rays to ultrahigh energies, two groups have reported searches for correlations between the directions of the 27 highest-energy cosmic-ray events reported by Auger last year and the locations of candidate source galaxies (see PHYSICS TODAY, January 2008, page 16). Matthew George (University of Cambridge) and coworkers have found a strong correlation between the arrival directions and the positions of active galactic nuclei closer than 300 million light-years with particularly intense hard x-ray output. The other correlation study, by Gabriele Ghisellini (Brera Astronomical Observatory, Merate, Italy) and coworkers, found a strong correlation between the arrival directions and the positions of galaxies with intense spectral emission indicative of abundant neutral atomic hydrogen and therefore of spiral galaxies with inactive nuclei. That suggests to Ghisellini and company that the sources of ultrahigh-energy cosmic rays may be newly born magnetars (hypermagnetized neutron stars) in nearby spiral galaxies rather than whole galactic nuclei acting as accelerators. (M. R. George et al., *Mon. Not. Royal Astron. Soc.* **388**, L59, 2008; G. Ghisellini et al., http://arxiv.org/abs/0806.2393.) —BMS ■