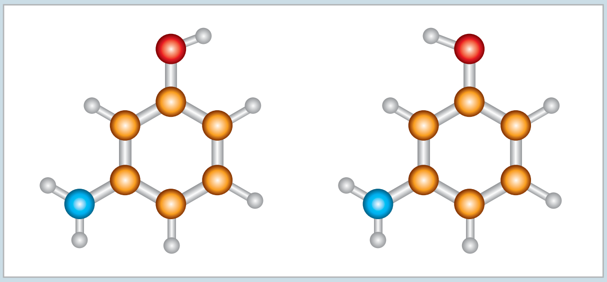
Traffic congestion drives urban evolution. As a city grows, it evolves from a so-called monocentric organization, with activities concentrated in the same geographical area—typically a central business district—to a polycentric organization, in which a number of subcenters coexist. Researchers Rémi Louf and Marc Barthelemy, both at France's Atomic Energy Commission in Saclay, have now developed a stochastic model that accounts for the emergence of that transition as an effect of rising traffic congestion. According to a 30-year-old economic model, the location at which individuals choose to work is one that maximizes income, taken as the difference between their wages and commuting costs. But cities are not static distributions of households and businesses; as populations increase, so do congestion and the time and thus cost of a commute. That trend, incorporated into the researchers' new model, reduces the attractiveness of some areas in which individuals might otherwise opt to work and raises the attractiveness of others, which become new subcenters. The model predicts that there always exists a critical value of the population above which a city abruptly turns polycentric and that the total commuting distance and number of subcenters in a city scale sublinearly with its population. Those predictions are consistent with data—specifically, the number of employees per ZIP code—gathered from some 9000 US cities between 1994 and 2010. (R. Louf, M. Barthelemy, *Phys. Rev. Lett.* **111**,198702, 2013.) —RMW

Newly sighted microwave-background polarization mode. The cosmic microwave background (CMB) has been streaming freely since the dawn of transparency, when the universe was only 4×10^5 years old and still incandescent. Now cooled to 2.7 K by 10^{10} years of cosmic expansion, the CMB still carries valuable imprints of the Big Bang, especially in its tiny departures from perfect isotropy. Harder to observe than the temperature anisotropies, which have for decades been a mainstay of cosmology's standard model (see PHYSICS TODAY, June 2013, page 18), are the much weaker spatial fluctuations in the CMB's polarization field—in particular their divergence-free *B* mode. (The designation *B* is meant to recall the divergence-free **B** field of electromagnetism.) The *B* mode is prized as a unique probe of primordial gravity waves thought to have been generated in the Big Bang. Now a collaboration using data from new polarization-sensitive detectors on the South Pole Telescope (shown in the photo) has reported the first detection of the CMB's *B* mode. The surveyed field of view, 10° × 10°, is still too small to reveal the large-angular-scale primordial gravity waves. But the team's analysis of the polarization data, in conjunction with the *Herschel Space Observatory*'s far-IR survey of the same patch of sky, has revealed the expected *B*-mode signature of gravitational lensing, a valuable probe of the mass distribution of the later cosmos. Furthermore, such lensing maps can be subtracted from larger *B*-mode surveys to facilitate the ongoing search for the primordial gravity waves. (D. Hanson et al., *Phys. Rev. Lett.* **111**, 141301, 2013.) —BMS

Conformer-dependent reactivity. Most organic molecules are flexible. Their chemical bonds can turn and twist, shifting the molecule into several distinct shapes called conformers. At room temperature, conformers often rapidly interconvert. But in a molecular beam, internal molecular motions are cooled and the interconversion is suppressed. Five years ago Jochen Küpper and colleagues showed that they could sort a molecular beam of 3-aminophenol into its two conformers, *trans*-3AP (on the left in the figure; carbon atoms are shown in yellow, oxygen in red, nitrogen in blue, and hydrogen in gray)



and *cis*-3AP (on the right). (See PHYSICS TODAY, June 2008, page 17.) Because *cis*-3AP has an electric dipole moment three times that of *trans*-3AP, it's more strongly deflected by an electric field gradient. Now Küpper and colleagues have teamed up with Stefan Willitsch to show that the conformers have different chemical reactivities. The researchers confined laser-cooled calcium ions in a cigar-shaped trap. Then they directed a beam of 3AP through an inhomogeneous electric field and toward the trap. Gradually tilting the angle of the beam allowed them to control which of the 3AP conformers interacted with the Ca^+ ions. By monitoring the Ca^+ population in the trap, they were able to derive the reaction rate constants for both conformers; the Ca^+ + *cis*-3AP reaction, they found, was twice as fast as the Ca^+ + *trans*-3AP reaction. The researchers are working to extend their method to other molecules and more complicated reactions. (Y.-P. Chang et al., *Science* **342**, 98, 2013.) —JLM

A metamaterial power harvester. Metamaterials are composite materials whose electromagnetic or acoustic properties are quite different from those of the subwavelength building blocks they comprise. By carefully tailoring small constituent pieces, researchers can create large-scale exotic phenomena such as negative indices of refraction, superlensing, and invisibility cloaking (see the articles by John Pendry and David Smith, PHYSICS TODAY, June 2004, page 37, and by Martin Wegener and Stefan Linden, PHYSICS TODAY, October 2010, page 32). Metamaterials have also shown promise for more familiar applications, including harmonic generation and nonlinear wave mixing. Allen Hawkes, Alex Katko, and Steve Cummer at Duke University have now demonstrated that metamaterials can function well as power harvesters, rectifying incident RF energy to deliver DC power to integrated components. The building block of the Duke metamaterial is a split-ring resonator: a nearly closed square metallic loop,