

concentration more precisely.

A typical experimental run at low dynamin concentration appears in figure 3. Micrographs are at the top, a plot of the tube radius versus time is at the bottom. Fluorescently tagged PIP₂ (top, red) delineates the GUV and the tube. Fluorescently tagged dynamin (top, green) shows up only when the tube is at its lowest radius, 10.4 nm.

By taking measurements over a range of concentration and radii, Roux and his coworkers could map a phase

diagram of dynamin's polymerization. Below a critical concentration c_v , dynamin never polymerized. At c_v , dynamin polymerized only on tubes whose radius matched dynamin's. As the concentration increased, dynamin polymerized on tubes of a widening range of radii. The lower limit of the range decreased weakly with concentration; dynamin couldn't polymerize on tubes that were too thin. The upper limit increased rapidly with concentration. Evidently, the vigor of dynamin

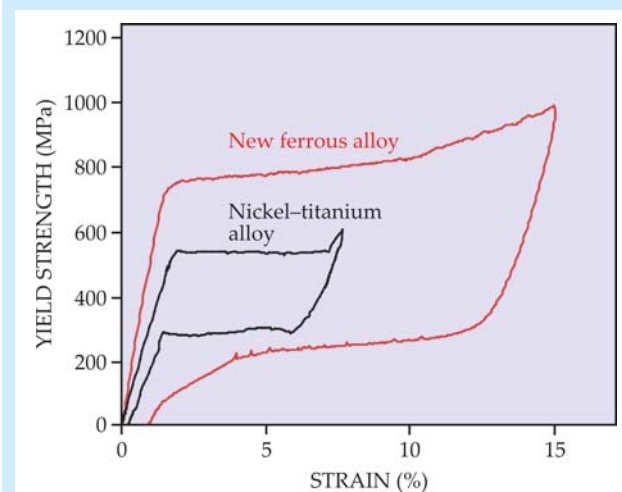
polymerization was enough to deform ever thicker tubes.

A simple mathematical model that balances polymerization energy, which depends on concentration, and the elastic energy, which depends on concentration and tube radius, could reproduce the phase diagram. The molecular picture that emerges from the experiment is of matching geometries. Curved monomers slide around on a curved surface and readily link if the two curvatures match. If they

physics update

These items, with supplementary material, first appeared at <http://www.physicstoday.org>.

Stretchy metals recoil. In materials, as the axiom goes, structure follows function: A metal's tightly bonded atomic crystal lattice gives it strength, and a polymer's mesh of macromolecular chains makes it elastic. Medical implants, electronic components, and other similar devices call for multifunctional materials



that are both strong and stretchy. One such material is the shape-memory alloy (SMA), a polycrystalline arrangement of assorted metals that, when stressed, undergoes a structural phase transition from high to low symmetry. The transition is reversible, and above a critical temperature SMAs are superelastic—they fully recover after being stretched well beyond the reversible-deformation strain values of pure metals. Now, materials scientists at Tohoku University in Sendai, Japan, have presented evidence for an iron-based SMA that is 35 times as elastic as pure metals. The new alloy, which also features nickel, cobalt, aluminum, tantalum, and boron, has an elastic strain of 13%, as shown in the figure, almost double the value of the more expensive commercial-standard nickel-titanium alloy. Furthermore, the material's yield strength, 800 MPa, is 1.5 times that of the nickel-titanium SMA. The researchers say that microstructured precipitates similar in composition to the bulk matrix and interspersed through it are a key to the improved mechanical strength. The greater elastic strain and strength could be exploited for mechanical damping in building materials. Also, the ferrous SMA's magnetism is phase dependent, which makes it

potentially useful for electromechanical sensing applications. (Y. Tanaka et al., *Science* **327**, 1488, 2010.) —JNAM

An unexpected cosmic current. According to cosmological theory, the expanding universe has no preferred direction. Thus, the cosmos may be likened to a rising loaf of raisin bread, with the raisins playing the roles of galaxies. Viewed from Earth (or anywhere else), the motion of a distant galaxy should be determined by the overall cosmic expansion. Now, following on their earlier work presented in 2008, Alexander Kashlinsky of NASA's Goddard Space Flight Center and colleagues report that superimposed on the cosmic expansion is a universal flow along the line from Earth to the Centaurus and Hydra constellations. The "dark flow," as the authors call it, was revealed in the cosmic microwave background by minuscule temperature fluctuations that arise when x-ray-emitting gas from galaxy clusters scatters off CMB photons. A catalog of more than 1000 x-ray-luminous galaxy clusters told Kashlinsky and company where in the *Wilkinson Microwave Anisotropy Probe's* five-year data set they should look for those fluctuations. The researchers had to average over ensembles of clusters to see evidence for the dark flow, which persisted unabated to the furthest measurable reaches, 2.5 billion light-years away. It's as if—and this is a literal possibility—matter beyond the edge of the visible universe is pulling the entire cosmos toward it. (A. Kashlinsky et al., *Astrophys. J. Lett.* **712**, L81, 2010.) —SKB

Prototype for a new astronomical detector. Much of the light emitted from stars and other astrophysical objects is absorbed by dust and reemitted at far-IR or submillimeter wavelengths—radiation that is notoriously difficult to detect. Last year researchers from the Jet Propulsion Laboratory proposed a new type of detector for that regime, with an eye toward future, more sensitive space missions. The team has now built a prototype microdevice (see figure), called a quantum capacitance detector (QCD), which would be one pixel in an eventual array. The detection chain goes like this: Photons are received at an antenna and fed into a superconducting absorber where they break Cooper pairs and generate quasiparticles. A superconducting island, called a single Cooper-pair box (SCB), is connected to the absorber in such a way that, at most, one quasiparticle at a time can tunnel onto it; that changes the island's capacitance, which is so small that the charging energy of a single electron has a large effect. With a resonant circuit, the physicists monitor the frequency of capacitance changes from which they can determine the density of quasiparticles in the absorber and thus the photon flux at the antenna. The device's performance is already comparable to that of other superconducting detectors. The advantage of the QCD, say the researchers, is the ease with