don't match, the linking can force a match, provided enough monomers are present.

Roux could also measure the polymerization force, which was manifest as a reduction in the force required to hold the bead in place. In general, the polymerization force depends on dynamin concentration and membrane tension. At a concentration of 12 μmol/L, the force is 18.1 ± 2.0 pN.

Interestingly, Roux's results imply that dynamin cannot exert enough force to overcome the higher membrane tensions measured in real neurons. However, certain membrane proteins appear in a nascent pit to reduce the tension and regulate the onset of endocytosis.

In the final stage of endocytosis, polymerized dynamin obtains energy from molecules of GTP (guanosine triphosphate, a common cellular fuel), twists into a tighter spiral, and garrotes the neck. When Roux was a postdoc in Pietro De Camilli's lab at Yale University, he, De Camilli, and their coworkers had verified the GTP-fueled twisting.[4] Now, Roux plans to measure the twisting force.

Charles Day

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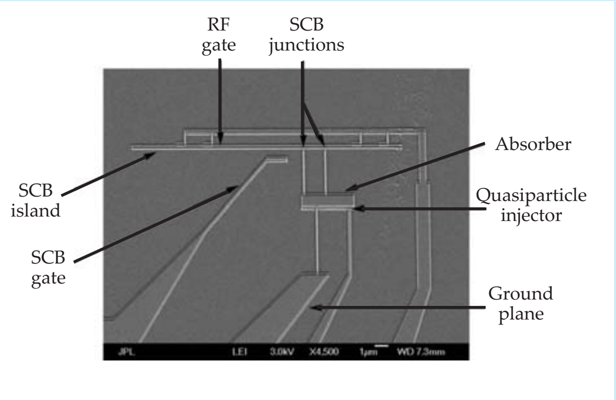
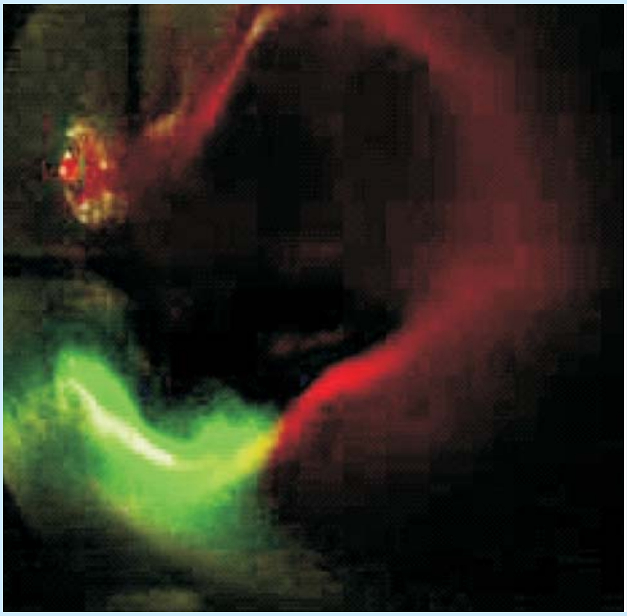


which it can be read out from an array of detectors. For example, each pixel detector could be fabricated with a different resonance and simultaneous readout could be done with a frequency comb. (J. Bueno et al., *Appl. Phys. Lett.* **96**, 103503, 2010.) —SGB

The intrinsic limits of quantum cascade lasers. One of the hallmarks of lasing is a dramatic narrowing of the light's frequency spread. In 1958 Arthur Schawlow and Charles Townes deduced that the laser linewidth is fundamentally limited by unavoidable spontaneous emission. (Thanks to other sources of noise, a real laser's linewidth is usually considerably broader.) Semiconductor diode lasers required a revision of the intrinsic linewidth formula to account for additional inherent broadening, but quantum cascade lasers (described in PHYSICS TODAY, May 2002, page 34) had been thought to obey the original limit. Now Saverio Bartalini and colleagues at Italy's National Institute of Optics–CNR, the European Laboratory for Non-linear Spectroscopy, and the Second University of Naples have confirmed a recent theory predicting that QCLs can in fact beat the Schawlow–Townes limit and yield significantly improved spectral purity. Key to the 2008 theory by Masamichi Yamanishi and coworkers at Hamamatsu Photonics was the recognition that nonradiative transitions in QCLs strongly suppress spontaneous emission. To test the prediction, the Italian researchers tuned their IR QCL to be halfway down a carbon dioxide absorption peak at 4.33 μm (69.3 THz). Thanks to the steep slope of the absorption curve there, frequency fluctuations were converted into detectable intensity variations. That technique enabled the team to measure the noise spectrum over seven decades of frequency and to extract the intrinsic QCL linewidths for various pump currents. The obtained widths, in the range of 500 Hz, agreed well with the new theory and were three orders of magnitude smaller than predicted by the venerable Schawlow–Townes formula. (S. Bartalini et al., *Phys. Rev. Lett.* **104**, 083904, 2010.) —RJF

Astrophysical jets and solar loops in the lab. At the center of many an active galaxy lies an exceedingly powerful engine that, among other things, shoots out collimated jets of fast-moving plasma. Such jets can extend well beyond the galaxy's luminous boundary, ending in vast lobes that light up the intergalactic medium in the radio band. Closer to home, the Sun's atmosphere has many a plasma-filled magnetic loop, the dynamics of which are somewhat mysterious. In February, at the joint meeting of the American Physical Society and the American Association of Physics Teachers, Paul Bellan (Caltech) reported on his group's recent experiments that shed light on both systems. The experimenters used the large currents and magnetic fields of spheromak technology to create plasma jets in a very large vacuum chamber, which ensured that the plasma configurations were unaffected by walls. With a preexisting magnetic field "frozen in," the physicists puffed some gas through an electrode, switched on a current, and watched as a plasma jet formed, self-



collimated, underwent a kink instability, and then detached when the electric current was strong enough. In a different magnetic-field geometry, the figure shows counterpropagating collimated plasma jets—red hydrogen from the cathode and green nitrogen from the anode—colliding head-on within an arched magnetic loop, much like those seen in the Sun's corona. Bellan also developed a physical model for the self-collimation and a dusty-plasma dynamo mechanism suitable for generating actual astrophysical jets. (P. M. Bellan et al., invited APS/AAPT talk H3.2, 2010. Preprint available from the author.) —SGB