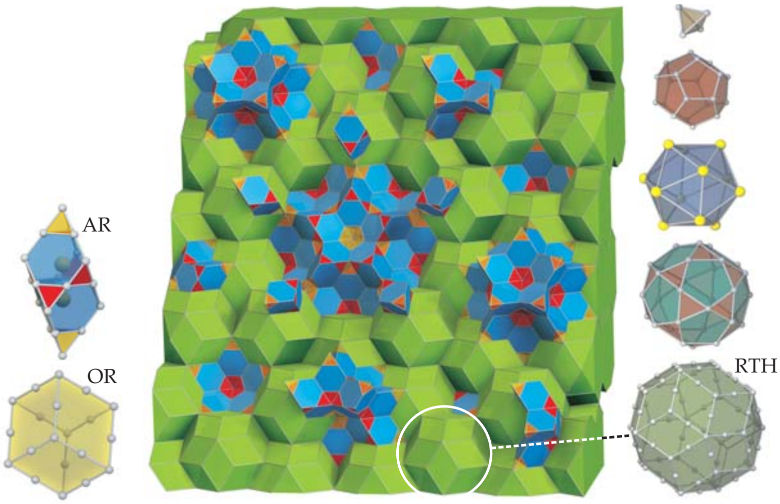


Three-dimensional structure of an icosahedral ytterbium–cadmium alloy. All of the alloy's atoms (Yb in yellow, Cd in gray) form a quasiperiodic lattice composed of just three geometrical motifs: the rhombic triacontahedron with its successively smaller subshells that nest inside, the acute rhombohedron, and the obtuse rhombohedron. The RTH makes up the bulk of the quasicrystal. The AR and OR link the RTH clusters together and fill in the gaps to preserve the fivefold icosahedral symmetry; obtuse rhombohedra, hidden here, are embedded below the surface. The cogwheel complex (center) and stellate polyhedra (top left and middle right) are recurring geometrical arrangements that self assemble. (Image adapted from ref. 3.)

or bronze. "Considering the quasicrystal's high symmetry, that's a quantity of data in reciprocal space matched only by the very largest biomolecules," comments Cornell's Veit Elser.

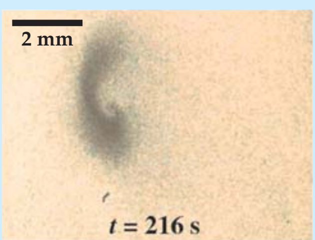
With just two elements, Yb–Cd offers the advantage of chemical simplicity. Until a few years ago, most researchers thought that only ternary quasicrystals could be stably formed. In 2000 Takakura and coauthor An Pang Tsai, then at the National Research Institute for Metals in Tsukuba, Japan, identified $YbCd_{5.7}$ as quasicrystalline, and it remains one of only two known stable binary quasicrystals (see PHYSICS TODAY, February 2001, page 17). Moreover, the large difference in atomic number between the two elements ideally suits the system for x-ray diffraction.

X-ray diffraction, however, captures the spatially averaged structure. Some atomic sites appear to be only partially occupied—that is, a site might be occupied at some locations in the sample, while equivalent sites remain vacant

physics update

Supplementary material related to these items can be found at www.physicstoday.org.

New blood-separation technique inspired by Einstein's tea leaves. Many medical diagnostic tests, including those for cholesterol levels, blood chemistry, and liver and thyroid function, are performed on blood plasma—the liquid part of the blood that's left after all cells and cellular components are removed. Obtaining purified blood plasma usually requires a lab with a large centrifuge, but scientists at Australia's Monash University have developed a new process based on the same principle that causes stirred tea leaves to accumulate at the bottom center of a teacup, a phenomenon first explained by Albert Einstein in the 1920s. A tiny amount of blood enters a microfluidic chamber, and a needle tip is placed at an angle just above the surface of the blood. With a sufficient voltage applied to the needle, air near the tip is ionized and the resulting "ionic wind" sweeps across the surface of the blood, causing it to circulate. To satisfy the boundary conditions, a secondary bulk meridional flow arises that carries the microscopic particles—red blood cells in the Monash experiments—in a downward spiral along the chamber's sides and radially inward at the bottom to a stagnation point at the center. The figure shows the separated cells collecting at the bottom after just a few minutes. The scientists say the technology could be incorporated into a low-cost, credit-card-sized device, but it may still be 5–10 years away from mass production. (D. R. Arifin, L. Y. Yeo, J. R. Friend, *Biomicrofluidics* **1**, 014103, 2007; http://bmf.aip.org.) —TB



Sizing the synaptic cleft. Unlike the transistors in a computer chip, the neurons in our brains are not directly connected to each other. A roughly 20-nanometer gap, the synaptic cleft, separates a neuron's output terminal from the input terminal of the next neuron in line. Signals cross the cleft as bursts of molecular ions called neurotransmitters. Once across, the neurotransmitters attach to receptors and trigger excitatory or inhibitory responses. Neurotransmitters come in several varieties, as do receptors, and the lateral area covered by a cleft varies several-fold from neuron to neuron. Yet the cleft height remains close to 20 nm. To find out why, Dmitri Rusakov of University College London and Leonid Savtchenko of Dnepropetrovsk National University in Ukraine developed a physical model. Narrowing the gap speeds transmission, as one would expect, but it also increases the electrical resistance of the intracleft medium. For a wide range of parameters, such as cleft area, diffusion coefficient, and number of receptors, the model yields an optimum cleft height of 15–20 nm, which matches the natural value. Evolution doesn't always produce the best designs, but given the importance of transmitting information inside our brains, it's not surprising that cleft height should be optimized. (L. P. Savtchenko, D. A. Rusakov, *Proc. Natl. Acad. Sci. USA* **104**, 1823, 2007.) —CD

Chaos on a chip. Semiconductor lasers are normally sensitive to perturbations that can induce unstable or noisy behavior. As the lasers become integrated into tiny photonic circuits, such chaotic nonlinearities might become magnified and thwart any desired uses of the circuitry. Mirvais Yousefi and his colleagues at the Eindhoven University of Technology in the Netherlands have developed a method to investigate nonlinearities in coupled lasers and have found surprising regularities. The researchers use a pair of lasers so close to each other on a chip that each affects the operation of the other. By monitoring the system's output dynamics as a function of the pump current, the researchers could directly visualize the period-doubling route