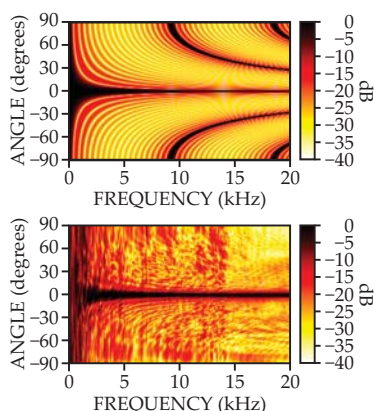


a new approach for directly and controllably generating pulsed vortex beams. To drive their pulsed laser, the researchers use a CW commercial laser diode that also has a doughnut-shaped profile. As the pump power increases, thermal effects in the pulsed laser cavity change the vortex mode that best couples to the input beam and gets preferentially pumped. Finally, a standard technique known as passive Q switching allows power to build up inside the cavity until it can be released in a short pulse. The net result is a train of stable, single-mode pulses with changeable vorticity. The pulses can also pack quite a punch: With roughly 10 W of pump power, the team demonstrated pulse energies up to 63 μJ and peak powers of more than 4.5 kW. (Y. Zhao et al., *Appl. Phys. Lett.* **101**, 031113, 2012.) —RJF

Seeing the sound to locate its source. Several microphones arranged in a given pattern can be used to locate a sound source by analyzing the phase mismatches of the signal at different receivers. That long-established technique is called beamforming. The top panel of the figure shows the output from a line of 19 microphones in response to a simulated incident plane wave. The dark lane at 0° identifies the direction of the source as being broadside; that lane would shift up or down for a source in a different angular direction.



The other dark lanes appearing at high frequencies are unavoidable artifacts—spatial aliasing—due to the discrete separations of a finite number of microphones. Those artifacts limit the technique to the lowest frequencies.

If infinitely many microphones formed a continuous line, the artifacts would go away and a larger frequency range could be used. Researchers from the Danish Fundamental Metrology Institute and the Technical University of Denmark recognized that sound creates variations in pressure—and thus in density—and that those variations affect the phase velocity of light. So they replaced the line of discrete microphones with a continuous laser beam, generated in a laser Doppler vibrometer (LDV) that typically samples a vibrating surface. Instead, they had the beam reflect off a rock-solid mirror and back into the LDV, thereby sampling the sound fluctuations along its path. The bottom panel shows an experimental realization of the researchers' theoretical analysis, with 0° now representing the head-on direction. With the LDV and reflector mounted on a turntable, the beamformer can be steered to find an acoustic source without any trace of spatial aliasing. The technique may prove useful where microphones cannot be deployed, such as in high-temperature environments. (A. Torras-Rosell, S. Barrera-Figueroa, F. Jacobsen, *J. Acoust. Soc. Amer.* **132**, 144, 2012.) —SGB

Earth's changing orbit shows up in tree ring data. Under the gravitational influence of Jupiter and Saturn, the ec-

centricity of Earth's orbit and the tilt and precession of its rotation axis slowly fluctuate. Those changes affect how much solar radiation reaches a given geographical location and are responsible for Earth's ice ages. According to a new study, they are also responsible for a more recent phenomenon: the cooling of Scandinavia from 138 BC to AD 1900 at a steady and significant rate of 0.31° per 1000 years. To reach that finding, Jan Esper of Johannes Gutenberg University Mainz in Germany and his collaborators assembled a record of tree rings from the trunks of young and long-dead Scots pines at 17 sites in northern Finland and Sweden. Thanks to the sites' stability and the availability of buried and submerged trunks, the record is unprecedented in its continuity and consistency. Orbital calculations indicate that summer insolation at northern latitudes has indeed been declining steadily for the past 2000 years, consistent with the long-term cooling that Esper and his collaborators inferred from their tree rings. However, the cooling trend is absent from other, less homogeneous tree-ring records that have been used to reconstruct northern Europe's past climate. If the Scandinavian tree rings embody the climate's true behavior, then summer temperatures during Roman times and the Medieval Warm Period were a few tenths of a degree higher than previously estimated. Yet even though summer insolation continues to fall in Scandinavia, the temperature trend manifested by the region's trees after 1900 is upward. (J. Esper et al., *Nat. Clim. Change*, in press.) —CD

Microfluidic chip sorts the living from the dead.

When a cell meets its demise, so too does its fine-tuned system for regulating nutrient uptake and waste excretion. As a result, cell death is typically marked by a sharp increase in electrical conductivity, as various ions become free to pass through newly opened pores in the cell membrane. That telltale change affords a convenient way to sort live cells from dead ones: In what's known as dielectrophoresis, electric-field gradients induce cells to migrate with a conductivity-dependent velocity. Exploiting the effect typically calls for fashioning tiny electrodes inside a microfluidic channel, but a group led by Xiangchun Xuan of Clemson University, South Carolina, has now devised a simpler alternative. The key was recognizing that a severe flow constriction is often sufficient, by itself, to distort an otherwise uniform electric field and create the strong gradients needed for dielectrophoresis. The essential component of the Clemson team's device is pictured here. Yeast cells generally flow from left to right, from a reservoir into a narrow microchannel, but near the constriction, dielectrophoretic forces oppose the bulk flow. Since those forces act more strongly on dead yeast than live ones, they can be tailored to trap dead cells in the reservoir while allowing live ones—fluorescent green in the image—to enter the channel. The researchers anticipate that their design can be integrated into lab-on-a-chip devices to aid in biomedical diagnostics and drug screening. (S. Patel et al., *Biomicrofluidics* **6**, 034102, 2012.) —AGS

