Shear drop

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Electrically conducting fluids can generate a magnetic dynamo when layers of fluid slide past one another, often at different rates. Known as shear, this is how the Earth and the Sun produce magnetic fields. But exactly how large-scale spatial coherence over the entire surface of the Sun can arise at high magnetic Reynolds numbers, as lines of magnetic field are dragged along by fluid flow, has remained unclear. For such turbulent flow, the magnetic field tends to have small-scale structure. Steven M. Tobias and Fausto Cattaneo report simulations that show how the observed organization is possible.

In their approach, the authors use the shear to suppress the growth of fluctuations at small scales, thus allowing the large-scale structure to flourish. When the fluid velocity has a strong helical component, they find two bands of magnetic structures with large-scale organization, which they identify as Parker dynamo waves — propagating hydromagnetic waves that were first predicted in 1955. It remains to apply this mechanism to a solar model, although it is appropriate for any astrophysical dynamo. *MC*

Light and fire

Nature Commun. **4,** 1869 (2013)

Lenses are usually fashioned from glass or other solid transparent materials, but, in principle, they could be made from pretty much anything — as long as the material transmits light and has a refractive index different from that of the medium in which the light is propagating. To make a gas lens, for instance, air is heated to create a gradient of refractive index that focuses the light. Using the same principle, Max Michaelis and colleagues have now demonstrated a flame lens for laser light.

Michaelis *et al.* combined a tubular gas-lens of limited focusing power with a spiral flame, which generated a steep gradient of temperature and refractive index. The result was an improved lens that was successfully tested with different types of laser: from imaging a pattern of low-power LEDs, to drilling a hole with a high-power Nd:YAG laser. However, the concept has yet to be optimized to eliminate the relatively high aberrations caused by uncontrolled hot air plumes.

Solid lenses are damaged by repeated exposure to high-power lasers — petawatt laser applications being the most challenging for conventional optics. The appeal of flame lenses is that they are virtually indestructible. *IG*

Camera *insecta obscura*

Nature **497,** 95–99 (2013)

The eyes of insects and spiders comprise hundreds or even thousands of individual photodetectors. They are highly sensitive to motion and can achieve a remarkable depth of field. Taking this evolutionary solution as their inspiration, Young Min Song and colleagues have engineered an artificial compound eye that is compatible with modern optoelectronic technology.

Choosing materials for their mechanical resilience, the team fabricated an array of 180 microlenses in an elastomer membrane, setting a silicon photodiode at the focal point of each lens. They then moulded the membrane into a hemisphere with a radius of curvature of 7 mm, without any optical misalignment.

Sensors in digital cameras tend to be flat because planar techniques are common in semiconductor processing. But the method demonstrated by Song *et al.* offers a scalable and affordable way to construct hemispherical optical components — potentially leading to cameras that have an improved angular field of view and fewer aberrations to off-axis light. *DG*

Within the rules

Phys. Rev. Lett. **110,** 201801 (2013)

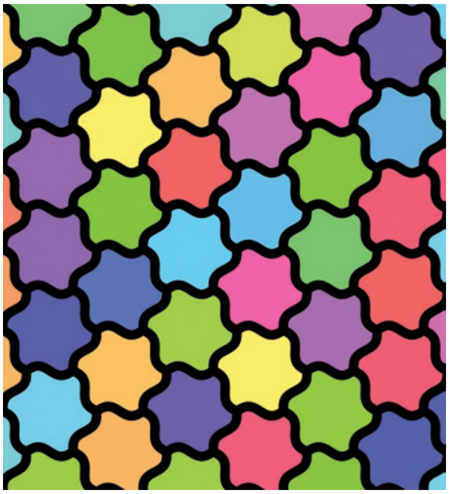
The standard model outlines the rules of particle physics, one of those rules being that the number of leptons of each flavour (such as electrons, muons and neutrinos) is conserved. So the decay of an antimuon into a positron and a photon is banned (or rather, it is heavily suppressed). That doesn't stop physicists trying to bend the rules, and looking for evidence of such a decay as a signal of new physics, beyond the standard model.

The MEG collaboration has collected a sample of more than 10^{14} stopped antimuons (using beams at the Paul Scherrer Institute, Switzerland) and searched for the distinctive signature of back-to-back, two-body decay of antimuon into positron and photon. Backgrounds are an issue, particularly from the allowed radiative decay of antimuon to positron, photon, neutrino and antineutrino. But recent upgrades to the detector (which comprises drift chambers, scintillators, a solenoid, and 900 litres of liquid xenon for photon detection) have enabled the MEG team to set the most stringent limit yet on the branching ratio for the decay.

Further data-taking and upgrades planned this year by the collaboration will stretch that limit still further — perhaps to the point where that rule of lepton conservation is broken. *AW*

Buckle up

Adv. Mater. http://doi.org/f2cq7b (2013)



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Imagine a honeycomb made from thin, rectangular elastic strips, attached to a substrate. If the strips swell, their edges buckle and — for linearly elastic strips — adopt sinusoidal profiles. The symmetry of the network then depends on the number of sinusoidal nodes on each edge. For an even number of nodes, the structure remains achiral: the handedness of neighbouring vertices alternates. An odd number of nodes (pictured) makes the cellular structure chiral.

Sun Hoon Kang and colleagues have derived a theoretical stability diagram that relates the number of nodes to the aspect ratio and differential swelling strain of the strips. They fabricated supported cellular structures from silicone rubber and epoxy resin, and then made them swell by wetting them with appropriate liquids. The chiral and achiral buckled-edge motifs developed as predicted.

The transfiguration works for different geometries (honeycomb and square lattices), and for both millimetre- and micrometre-sized edges. Defect-free patterns can be created by starting the wetting gradually from a single spot. Furthermore, the procedure is reversible, with 'unwetting' achieved through evaporation, and also reproducible: wetting a given sample again after four months produced exactly the same buckling-induced, lowered-symmetry patchwork. *BV*

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