

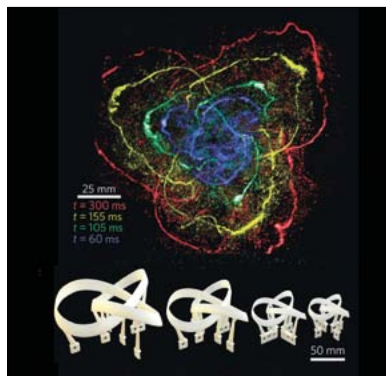
Sciencewatch

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Vortices tie water into knots

Rings in fluids, such as smoke rings, are easy to form by pushing the fluid quickly through an orifice. But what about knotted rings? Such knots are expected theoretically in many branches of physics and they have now been made in the laboratory. Dustin Kleckner and William T M Irvine of the

Top: An overlay of vortex knots taken at the same rescaled time. The vortex r.m.s radii are 60, 45, 30 and 22.5 mm for red, yellow, green and blue colouring, respectively. The generating wing speed is 3.10 m s^{-1} for all except the largest vortex knot, for which it is 2.15 m s^{-1} . Bottom: A photograph of the four knot-generating wings.



University of Chicago used a 3D printer to make a tiny, knotted aeroplane wing that, when suddenly accelerated, throws off a trefoil-shaped knotted vortex.

The researchers even managed to make the rings visible by injecting tiny gas bubbles into the fluid, which were pulled into the knotted vortex. The work finally shows that these knotted vortices do, indeed, exist and opens hopes for a whole new field in fluid mechanics.

● Further reading

D Kleckner and W T M Irvine 2013 *Nature Physics* doi:10.1038/NPHYA2560, published online 3 March.

Spin–spin interactions and the Earth’s Core

Many theories suggest weak, but long-range interactions between spins but now new and better limits have been obtained using the Earth’s core as a huge source of polarized electrons. Larry Hunter of Amherst College and colleagues argue as follows. The Earth’s mainly iron core has about 10^{49} unpaired electrons, of which about 1 in 10^7 will be polarized. That makes for 10^{42} polarized fermions, which is more than 10^{17} times larger than in any laboratory experiments.

The researchers reanalysed previous laboratory experiments, taking into account the Earth’s core. They found that for a power law that falls sufficiently slowly, the new analysis leads to limits thousands of times better, even though laboratory-polarized sources are only tens of centimetres away from detecting devices while the Earth’s core is a few thousand kilometres away – a nice example of thinking “outside the box”.

● Further reading

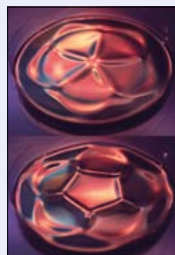
L Hunter *et al.* 2013 *Science* **339** 928.

Smelling in stereo

While stereo sensing for sound and light is common, there has been no clear evidence of an olfactory analogue. Now, Kenneth Catania of Vanderbilt University has made studies of the blind eastern American (or common) mole. Not only blind but with poor hearing and a bad sense of touch, the animal can head straight to food after a quick sniff. Plugging

Star-shaped waves

Vibrating a thin layer of silicon oil in a flat container can produce standing waves of a kind never seen before. Jean Rajchenbach and colleagues of the University of Nice find that for strong enough vertical vibrations, patterns emerge that alternate between a star and a polygon, with n -fold symmetry determined by the frequency and intensity of the vibrations but not by the shape of the container. The team tracks these brand-new forms of standing waves down to a nonlinear resonance-coupling between waves.



An example of a new type of standing wave that alternates between a five-pointed star and a pentagon.

● Further reading

J Rajchenbach *et al.* 2013 *Phys. Rev. Letts.* **110** 094502.

either nostril makes the animal veer in the direction of the open one and putting tubes in their nostrils and crossing them makes the moles go left when they should go right and vice versa – something that would not happen if they were just moving towards a stronger scent with no left-right discrimination.

Because the moles dig for their food, they may need this faculty to avoid wasting large amounts of energy in moving soil unnecessarily. It remains to be seen if other animals share this skill and to what degree.

● Further reading

K C Catania 2013 *Nature Communications* **4** 1441.

Psychiatric drug makes fish bolder

While it is known that pharmaceuticals enter aquatic ecosystems as pollution, little has been known about their effects on wildlife. Now, there is some disturbing news from studies of fish. Tomas Brodin and colleagues at the University of Umeå in Sweden subjected wild European perch (*Perca fluviatilis*) to oxazepam – a benzodiazepine anxiolytic drug used to treat anxiety – at levels of $1.7 \mu\text{g/l}$. Fish from the Fyris river had been found in the wild to have six times the concentration as the surrounding water ($0.58 \mu\text{g/l}$), indicating that the drug concentrates in the fish, so the dose seemed a fair one for a quick test.

After seven days, the fish had levels similar to what they received in the wild. The perch, which are normally shy and hunt together, showed increased activity, reduced sociability and higher feeding rates. This is just one drug of a vast cocktail that is now found in natural water sources, so there is clear cause for concern.

● Further reading

T Brodin *et al.* 2013 *Science* **339** 814.