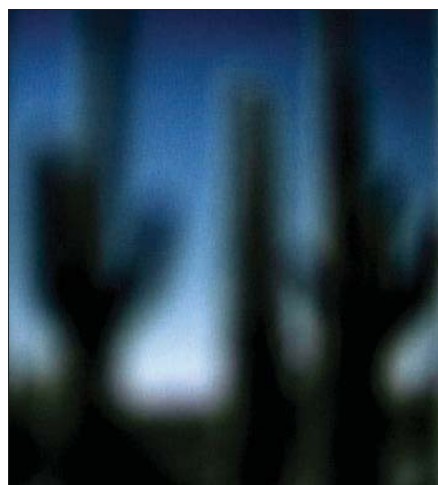


Liquid crystals could make bifocals a thing of the past



Left: A scene viewed with the new lenses switched on – to see a picture close up. Right: the scene with the lenses off – without power the picture blurs. (Courtesy UA optical sciences.)

As most people get older, they lose their ability to focus on close objects and many start to use glasses that have different focusing powers in different regions – bifocals and varifocals. Now a breakthrough from Guoqiang Li of the University of Arizona (UA) in Tucson and colleagues could make bifocals a thing of the past. The team reports a new form of diffractive lens based on a thin ($5\ \mu\text{m}$) layer of fast-switching (less than 1 s) nematic liquid crystal.

The liquid-crystal layer is formed between two pieces of flat glass, each coated with indium tin oxide, which acts as a transparent electrode. A small applied voltage switches this layer between acting as normal glass (the upper part of most bifocals, used for viewing long distances) and as a lens for close-up

work (like the lower part of most bifocals).

In the prototype the wearer has to switch between the two focusing regimes, but the researchers envisage automatic switching that works rather as in an auto-focusing camera. Future developments could also benefit anyone who has to wear glasses, whether young or old. Glasses with adjustable focusing power could be reprogrammed rather than replaced by an optician to match changing requirements, so that one pair of spectacles could last a lifetime.

Further reading

Guoqiang Li *et al.* 2006 *Proc. Natl. Acad. Sci.* **103** 6100.
www.pnas.org/cgi/reprint/0600850103v1.

Gentle droplets can create a big kick

There is some great physics in the simplest of systems. Even a falling drop of water can hold interesting surprises, as Denis Bartolo from the Ecole Normale Supérieure in Paris and colleagues have found.

A gently falling droplet striking a water-repellent surface can produce a jet that goes

upwards at 40 times the impact speed. The large kick comes from two hydrodynamic instabilities associated with a trapped air cavity that forms when the drop hits. This is a nice example of how collective phenomena can give rise to large effective upconversions and perhaps suggests interesting applications.

Further reading

Denis Bartolo, Christophe Josserand, and Daniel Bonn 2006 *Phys. Rev. Letts.* **96** 124501.

Light rotation could be caused by axion

Researchers at the Italian National Institute of Nuclear Physics have observed the rotation of the polarization of light in a vacuum due to a transverse magnetic field. Emilio Zavattini and colleagues in the PVLAS Collaboration sent a linearly polarized laser beam through a 5 T field produced by a 1-m long superconducting dipole magnet and observed the polarization. Using light at a wavelength of 1064 nm, they made 44 000 passes, measuring an average rotation of $3.9 \pm 0.5 \times 10^{-12}$ rad for each pass.

Some rotation is predicted from quantum electrodynamics via an effective four-photon vertex. The result here, however, suggests additional, new physics, such as the presence of an axion coupling to the scalar product of electric and magnetic fields. Axions, which couple to two photons, are light, neutral bosons, originally hypothesized to explain the absence of CP violation in strong interactions. Further results are eagerly awaited.

Further reading

E Zavattini *et al.* 2006 *Phys. Rev. Letts.* **96** 110406.

Artificial muscles can run on fuel cells

Ray H Baughman of the University of Texas in Dallas and colleagues have demonstrated an effect that could change the way we think about designing robots and prosthetic limbs. The novel idea is to have a fuel cell in the artificial muscle itself as an integral part of its functioning. The artificial muscle converts the chemical energy of high-density fuels to mechanical energy without the need for batteries that must be electrically recharged.

The most striking of the new designs is based on shape-memory alloy and a platinum catalyst, and uses oxygen and either hydrogen or methanol. It provides a power density similar to that of natural skeletal muscle, but produces stresses a hundred times larger.

Further reading

Von Howard Ebron *et al.* 2006 *Science* **311** 1580.

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