

Fibre event horizon could test Hawking radiation

You can think of a black hole as an object whose escape velocity is greater than or (in the limit) equal to the speed of light, but what happens if you pick a situation where the speed of light is less than it is *in vacuo*?

Such laboratory analogues of real black holes have long been of interest, and the latest, by Ulf Leonhardt of the University of St Andrews and colleagues, comes closest to providing an analogue of Hawking radiation, which should be emitted at the event horizon of a black hole.

The model is simple and beautiful. A pulse of infrared light is sent down a fibre with a second pulse of longer wavelength and faster light sent in close behind.

The light in the first pulse reduces the local index of refraction of the fibre so that the second one slows down as it approaches, eventually “piling” up and then “sliding back”. The system is really closer to a white hole (i.e. a black hole in reverse). However, the strongly varying index of refraction with position should mimic the varying geometry of space–time near a black hole and pull photons out of the vacuum in much the same way that Hawking predicted. Experiments should prove interesting.

Further reading

TG Philbin *et al.* 2008 *Science* **319** 1367.

Sea cucumbers inspire polymer research

Some biological systems such as the sea cucumber can change their stiffness in remarkable ways, and now engineers have figured out how to mimic this in a family of polymer nanocomposites. Christoph Weder of Case Western Reserve University and colleagues, have investigated materials consisting of a rubber-like polymer that contains rigid cellulose nanofibres.

The researchers demonstrated reversible reductions in the tensile modulus by factors of 40 and more in response to chemical changes. Work is now under way to see if the same can be achieved in response to electrical or optical stimuli, which could lead to all sorts of interesting applications. The researchers are interested in biomedical



The sea cucumber's ability to change stiffness has inspired research with medical applications. (Courtesy Isabel Poulin/Dreamstime.com.)

applications, in particular for implants that can record brain activity for use with medical conditions such as Parkinson's disease.

Further reading

JR Capadona *Science* **319** 1370.

Compound enables self-cleaning cloth

Clothes that clean themselves could soon be available based on the work by Walid Daoud of Monash University in Churchill, Australia, and colleagues, and at Hong Kong Polytechnic University in Kowloon. The idea is to coat clothing fibres with tiny particles of titanium dioxide, which acts as a catalyst to

break down dirt and stains when illuminated with sunlight.

The catalyst will also work, though less well, in ordinary light, and it also inhibits the growth of bacteria.

Ultimately the compound could help to reduce the amount of detergent, energy, and water used in washing clothes.

Further reading:

WA Daoud *et al.* 2008 *Chemistry of Materials* **20** 1242.

The physics of pastis

Pastis, ouzo, absinthe and many others lumped under the rubric “PLBs” (pastis-like beverages) owe most of their cloudiness on mixing with water to the formation of a cloud of droplets of an oily substance, trans-anethol. The anethol, which gives the drink its distinctive flavour, is soluble in the alcohol (ethanol) in the bottled beverage but insoluble in water.

Erik van der Linden of Wageningen University in the Netherlands and colleagues have made a detailed study of “la louche” and found that experiment defies conventional theory. For example, they found that the growth rate of the droplets of oil decreases as the concentration of ethanol increases, in exact contradiction to predictions. Apart from providing something to talk about over a drink, a better understanding of this spontaneous emulsification process could impact on the chemical industry.

Further reading

E Scholten, E van der Linden and H This 2008 *Langmuir* **24** 1701.

Bacteria and snow

Sometimes things that are right under your nose are surprisingly poorly understood. David Sands of Montana State University in Bozeman and colleagues have looked at snow samples from various parts of the world and at various temperatures, and studied ice nucleators of biological origin (i.e. microorganisms that help crystals of ice to form). Despite the fact that such nucleators have been known to exist for nearly 40 years, this new research suggests that they may play a more important role than had ever been imagined.

In particular the group studied biological ice nucleators that are active at temperatures above -10°C , in places as varied as Antarctica, France and Montana, and discovered that they are common in fresh snow worldwide. The results could have interesting implications for feedback between the biosphere and the climate.

Further reading

BC Christner *et al.* *Science* 2008 **319** 1214.