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1. Sterile neutrinos

According to some theoretical models, along with the electron, muon, and tau neutrinos — elementary particles which interact extremely weakly with matter — there also exist so-called sterile neutrinos, whose interaction is even weaker. Scientists working with the Super-Kamiokande detector in Japan have recently suggested the existence of neutrino oscillations, i.e., of processes in which muon neutrinos transform into tau and, possibly, sterile varieties. The origin of muon neutrinos is the decay of muons produced by cosmic rays in the upper atmosphere. A new analysis of data has shown, however, that neutrino oscillations — if they exist at all — occur between muon and tau neutrinos only and do not involve the hypothetical sterile variety.

Source: http://prl.aps.org
Phys. Rev. Lett. **85** 3999 (2000)

2. The smallest nanotubes

One of the most promising lines of research in solid state physics and microelectronics is that dealing with carbon nanotubes — microscopic hollow cylinders of carbon with walls just one atom thick. Apart from offering unique electrical properties, nanotubes also have good heat conductivity [see *Usp. Fiz. Nauk* **170** 1142 (2000)]. A Japanese team working in collaboration with Hong Kong University has succeeded in fabricating the smallest nanotubes ever observed, whose diameter, a mere 0.4 nanometers, represents the lower theoretical limit for a nanodevice.

Source: http://www.sciam.com/news/110600/4.html
Nature **408** 50 (2000)

3. Surface acoustic waves

A Japanese scientist Y Tsukahara and his colleagues performed an experiment in which sound travelled along and around the surface of a small glass sphere. To avoid strong dispersion of the surface acoustic wave (known as a Rayleigh wave), a tightly focused wave was used in the piezoelectric generator and a wave packet of special shape was employed.

Source: *Physics News Update*, Number 509
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT
Appl. Phys. Lett. (2000) 30 Oct.

4. Vortex inside a vortex

Researchers at the University of California have been studying the behaviour of vortices placed within a larger-sized vortex. Since vortices in a real liquid are rather difficult to study because of viscosity, the UC team employed a magnetized two-dimensional electron gas with properties close to those of an ideal liquid, and used a photocathode to create electron vortices in it of the required configuration. A small vortex so produced first circulated together with the material of the larger one, and then an oppositely spinning vortex-like 'hole' developed within its orbit, whose growth ultimately made the motion of the entire system chaotic. This effect had been predicted theoretically. Similar phenomena may occur in oceanic vortices and in the dense atmospheres of giant planets.

1. Nezlin M V *Usp. Fiz. Nauk* **150** (1) 3 (1986) [*Sov. Phys. Usp.* **29** (9) 807 1986)]; Nezlin M V, Snezhkin E N *Vikhri Rossbi i Spiral'nye Struktury: Astrofizika i Fizika Plazmy v Opytakh na Melkoĭ Vode* (Moscow: Nauka, 1990) [Nezlin M V, Snezhkin E N *Rossby Vortices, Spiral Structures, Solitons* (Berlin, Heidelberg: Springer-Verlag, 1993)]

Source: *Phys.Rev.Lett.* **85** 4052 (2000)
http://physicsweb.org/article/news/04/11/4

5. Plasma lens

Electron and positron beams are usually focused by means of a magnetic quadrupole lens, but this technique does not work for beam energies above a few GeV. Researchers at the Stanford Linear Accelerator Center (SLAC) in the USA have now discovered that plasma placed in a magnetic field has better focusing properties than a magnetic field alone — presumably because the Coulomb repulsion between beam particles is overridden by the attraction of oppositely charged plasma particles. Using a plasma lens, the group achieved a three-fold narrowing of a 30-GeV electron beam and has been able for the first time to focus a positron beam of the same energy.

Source: *Physics News Update*, Number 508
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT

6. Iron line in the spectrum of a gamma-ray-burst

The observation of the optical and X-ray afterglow of gamma-ray bursts is solid evidence for their cosmological origin, but even within the cosmological scenario a number of hypotheses, such as colliding neutron stars, 'hypernovae', cosmic string vibration, etc., still continue to compete. Now Chandra observations will possibly narrow the choice after the spectrum of the X-ray afterglow of the gamma-ray burst GRB991216 has for the first time revealed the presence of iron emission lines. From the redshift and width of the lines, the distance to and some characteristics of the burster were determined. It turned out that matter is expelled from the burst at about 10% of the speed of light and that the mass within a radius of 1–2 light days is at least one tenth of the solar mass. While reminiscent of the 'hypernova' model, this picture implies more energy release than previously thought.

Source: http://chandra.harvard.edu

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