

PACS number: **01.90.+g**

Physics news on the Internet (based on electronic preprints)

DOI: 10.1070/PU2003v046n05ABEH001415

1. B meson decay

Decays of B mesons into two baryons have been observed for the first time at the KEK laboratory in Japan. Previously, only three- and four-particle decays of B mesons, with mesons present among the decay products, were evidenced. The B meson consists of a heavy anti-b-quark plus another, lighter quark. The new experiment has recorded B meson decays into an antiproton and a Λ_c^+ particle consisting of u, d, and c quarks. The measured probability of such a decay is 2.19×10^{-5}, i.e., an order of magnitude less than for three-particle decays. Among the several proposed theories of B meson decay, the one which involves Regge poles most accurately describes the experimental data.

Source: *Phys. Rev. Lett.* **90** 121802 (2003)
http://prl.aps.org

2. Properties of deformed nanotubes

It has been predicted by a number of theoretical studies that carbon nanotubes, when subjected to a mechanical force, should change their conductivity due to a change in the forbidden gap in the energy spectrum of the electrons. Depending on the orientation of the graphite hexagonal grid relative to the nanotube axis, either a decrease or an increase in conductivity should occur. Indeed, T W Tombler and his colleagues observed a reduction in conductivity of more than an order of magnitude in their experiments in 2000, but it was unclear whether this was related to the energy gap width or was due to other reasons. Now E D Minot and his colleagues at Cornell University have carried out a new experiment in which nanotubes, with electrodes attached to their ends, were deformed (i.e., stretched or bent) by the tip of an atomic force microscope. In some cases, not only a reduction, but also an increase in conductivity was evidenced. The tip of the microscope also served as a gate for controlling the electric potential across the central part of the nanotube and the current through the tube. From the way the tube resistance depends on voltage, it is the change in the energy gap width which dominates variations in nanotube conductivity.

Source: *Phys. Rev. Lett.* **90** 156401 (2003)
http://prl.aps.org

3. Tunable photonic crystals

Certain types of photonic crystals (structures with a periodically varying index of refraction, liquid suspensions being an example) can change their properties under the influence of external forces, but this process takes a long time to complete. J Qi and his colleagues at Brown University have created photonic crystals which take only a few milliseconds to rearrange structurally. The crystals were fabricated from the so-called holographic-polymer dispersed liquid crystals (H-PDLCs). The samples were illuminated by four coherent laser beams. At the peaks of the interference pattern obtained, liquid crystal droplets formed to constitute a superlattice. The drops could change their index of refraction under the influence of an electric field, thus changing the spectrum of radiation transmitted by the crystal. The new photonic crystals may find a number of useful practical applications, according to the authors.

Source: http://www.aip.org/physnews/update/
Physics News Update, Number 633

4. Magnetic levitation in cold oxygen

In magnetic levitation experiments, a nonuniform magnetic field creates a force which balances the weight of a diamagnetic body used. The elevating force increases significantly if the body is immersed in a paramagnetic medium. In previous experiments, gaseous oxygen at high pressures was used as a medium. Now L Eaves and his colleagues at Nottingham University in Great Britain have developed a method for achieving levitation in an open vessel with liquid oxygen at atmospheric pressure. In this way, heavy diamagnetic (lead and gold) samples and even light paramagnetic materials could be suspended in a relatively weak magnetic field. In the same experiment, a regular lattice of convexities was found to form on the surface of liquid oxygen in magnetic fields in excess of 17 T. The surface of this shape minimizes the sum of magnetic and surface energies. Previously such lattices were observed only on the surfaces of synthetic ferromagnetic liquids.

Source: *Nature* **422** 579 (2003); www.nature.com
http://physicsweb.org/article/news/7/4/9

5. A gamma-ray burst from a supernova

There has been evidence in recent years that at least some gamma-ray bursts are related to supernova explosions. N R Butler and his colleagues have obtained new important data of this kind using the orbital Chandra X-ray Observatory. The X-ray afterglow of the gamma-ray burst GRB 020813 was registered for 21 hours by the HETE spectrometer. The team observed an increased content of chemical elements characteristic of supernova explosions: in particular, the spectral lines of silicon and sulphur ions were seen. Compared to observations by other telescopes, the lines were detected with a high level of reliability, the probability of statistical fluctuation being less than 0.01%. From the Doppler shift of the lines, it was found that the ions moved at about 1/10 the speed of light, probably through the expanding

Uspekhi Fizicheskikh Nauk **173** (5) 570 (2003)
Translated by E G Strel'chenko

supernova shell. The narrow width of the spectral lines suggests that the ions formed in a small volume of space. Most probably the shell was illuminated by a narrow beam of fast particles emitted by the accretion disk around a black hole — remnant of a supernova. Calculations show that the supernova exploded about two months before the gamma-ray burst occurred. The observations support the so-called 'supranova' model proposed by M Vietri and L Stella in 1999. The basic features of the model are the explosion of a very massive star and the collimation of a particle beam near a black hole.

Source: http://arxiv.org/abs/astro-ph/0303539

Compiled by *Yu N Eroshenko*