

Physics news on the Internet (based on electronic preprints)

1. Life on Mars: new evidence

The recent discovery by U.S. researchers of traces of primitive single-cell life in a meteorite of Martian origin was already reported in *Uspekhi Fizicheskikh Nauk* (*Physics-Uspekhi*). Analogous investigations have been conducted by C Pillinger and his colleagues from the Britain's Open University. This time along with the meteorite explored previously, another meteorite that came to Earth from the red planet was analysed. British scientists have confirmed the conclusions drawn by their U.S. colleagues with respect to the former meteorite and, additionally, they have also discovered the presence of organic matter in the second meteorite. The chemical composition of organic matter found in the second meteorite differs in some respects from the composition observed by the U.S. team; this points to the fact that different reactions led to the synthesis of organic matter in this case. The scientists measured the ratios of light to heavy isotopes of carbon in both meteorites and arrived at the conclusion that such carbon-compounds could be by-products of methane given off by microbes. While the age of the first meteorite exceeds 3 milliard years, the age of the second one, as scientists estimate it, is only 600000 years. The discovery of more recent traces of life lends some hope to the belief that Martian microorganisms have survived until our days and will be discovered directly on Mars by spacecrafts. NASA has already started the program of launching to Mars the series of automated stations, one, in particular, with a robot-vehicle intended to carry out mineralogical investigations. In 2003, it is planned to launch a spacecraft which will return to Earth samples of Martian rock. In 2001, perhaps, we will observe the launch of Russian spacecraft with its own Martian vehicle onboard.

Source: http://science-mag.aaas.org/science
Science, 31 October 1996

2. Dynamics of vortices in superconductors

Experimentalists have undertaken many efforts in attempts to rise the critical current density (at which superconductivity is destroyed) in superconductors by doping them with artificial defects. The defects counteract the Lorentz force with which the current acts on the magnetic vortices which are present in superconductors. The critical current attains a maximum at some specific value of the external magnetic field H^* in which the superconductor is imbedded. It is believed that this feature owes its existence to an intricate interaction between defects and vortices. To clarify the situation scientists needed the dynamic picture of the behaviour of vortices in the presence of the magnetic field. Until very recently, only some static configurations could be observed with available equipment.

A Japan – Belgium research team, by exploiting new methods of electron holography and Lorentz microscopy, has carried out direct observations of dynamics of magnetic vortices in superconductors. A thin niobium film having a regular array of artificial defects was studied. The motion of vortices was observed when both the temperature and magnetic field were varied. It has turned out that at H^* the vortices arrange themselves in what may be called a crystal lattice, the latter based on the structure of the defects. Arranged in this way, the vortices are in the most stable state, which explains the maximum in the magnitude of the critical current.

Source: http://science-mag.aaas.org/science
Science, 15 November 1996

3. Artificial membranes

Artificial membranes — analogues of cell membranes — consist of lipid molecules possessing water-repelling 'lipid tails'. Being placed in water, these molecules achieve an energy minimum by forming a closed bubble with their lipid tails hidden inside. The bubble membrane is tight enough, and objects enclosed by it are well isolated from the external medium. An Israel-U.S research team has devised a technique to manipulate the permeability of the membrane with the help of laser. If a laser beam is focused on the bubble surface, lipid bonds break under the action of light wave electric field, and pores form in the bubble membrane. Surrounding water then fills partially the volume of the bubble thus expelling the objects from inside the bubble. Interestingly enough, these objects may reach 3/4 of the bubble diameter in size. The new technique can find use in numerous biochemical research.

Source: http://www.hep.net/documents/
newsletters/newsletters.html
Physics News Update, No 296

4. Observations of quasars

Observations of tens of quasars and their host galaxies have been conducted with the help of the Hubble Space Telescope. It was unexpectedly found that these galaxies do not belong to some definite type. On the contrary, they may have different morphological types: spiral and elliptic ones. Of special note is the fact that, for their most part, the galaxies hosting quasars are in the process of collision with other galaxies. Because of strong gravitational perturbations, fast jets of chaotically moving matter arise in colliding galaxies. According to one of hypotheses, an impact of the matter from such a jet on a black hole located at the centre of galaxy may lead to the release of vast amounts of energy; this may explain the phenomenon of quasar. As is well known, the brightness of quasars exceeds 100 – 1000 times that of ordinary galaxies. However several quasars were discovered in 'quiet' galaxies absent of any features pointing to collisions with other galaxies. The above-described observations support a viewpoint that many galaxies, with all probability including our one, had passed the stage of quasar activity some milliard years ago. In other words, the quasars are frequent, but not long-lived phenomenon in lives of many galaxies. The discovery of the quasars dates back to 1963, however the mechanism of energy release that occurs in them is as yet obscure.

Source: http://www.hq.nasa.gov/office/pao/
NewsRoom/releases.html, *NASA Press Releases*

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