

Physics news on the Internet (based on electronic preprints)

1. Neutrino oscillations

New results bringing the evidence of neutrino oscillations — the transition of neutrino of one kind into another — have been obtained at the Los Alamos National Laboratory. While first reports (see *Uspekhi Fizicheskikh Nauk* **165** 720 (1995) [*Physics–Uspekhi* **38** 683 (1995)]) were based on the data obtained in 1993 – 1994, at present information collected in 1995 is also processed. The increase in statistical material has enabled the reduction of the influence of background events and in this way made the conclusion about the oscillations more reliable.

The experiments involved search for $\bar{\nu}_\mu \to \bar{\nu}_e$ transitions by using $\bar{\nu}_\mu$ from μ^+ decay at rest. μ^+ were produced by employing protons accelerated to 800 MeV at the Los Alamos Meson Physics Facility (LAMPF). In collisions of protons with water target π^+-mesons form; μ^+ are the product of their decay: $\pi^+ \to \mu^+\nu_\mu$. The $\bar{\nu}_e$ are detected via the reaction $\bar{\nu}_e\, p \to e^+ n$, correlated with a γ from $np \to d\gamma$ (2.2 MeV). Recording photons due to the last reaction raises the accuracy in determining the number of e^+. If attributed to $\bar{\nu}_\mu \to \bar{\nu}_e$ oscillations, the excess in the observed e^+ number corresponds to an oscillation probability of $(0.31^{+0.11}_{-0.10} \pm 0.05)\%$.

Source: http://xxx.lanl.gov
nucl-ex/9605003

2. New theory of sonoluminescence

Claudia Eberlein of Cambridge University has suggested a new theoretical explanation of the sonoluminescence phenomenon. The essence of the latter is in light emission on interaction of ultrasonic beam with air bubbles in water. Under the action of sound the bubbles shrink and emit light pulses with a duration of less than 12 ps. The radiation spectrum resembles that of black body with a typical temperature of several thousand kelvins. Earlier theories attributed the light emission to the plasma formed at shrinking. According to the theory of C Eberlein, the light is being emitted by 'zero-point fluctuations' of vacuum surrounding the bubble. The rapid motion of air-water interface changes the dielectric permittivity of the media and facilitates the conversion of virtual photons into real ones.

Source: http://www.hep.net/documents/newsletters.html
Physics News Update, No. 267

One may read about the sonoluminescence in

1. Putterman S J *Sci. Amer.* **272** (2) 32 (1995)
2. Lofstedt R, Barber B P, Putterman S J *Phys. Fluids A* **5** 2911 (1993)

3. Solar activity

Observations of the Sun carried out by recently launched Solar and Heliospheric Observatory (SOHO) spacecraft revealed unexpectedly high small-scale activity on the Sun. SOHO is a joint project between NASA and the European Space Agency. The spacecraft is on location in space near the L-1 Lagrangian point (approximately 2 million km from the Earth), where the Earth's and Sun's gravitational forces balance. This enables solar astronomers to observe the Sun continuously.

Observations in the UV range have shown that small-scale motion of the medium and other active processes occur on the Sun. Disturbances are present even within so-called 'coronal holes', areas of particularly low density and temperature where magnetic field lines are open and stretch out infinitely into interplanetary space. The ultraviolet images revealed the sources of polar plumes to be seething regions of wildly gyrating magnetic fields and turbulent solar gases. The brightness of sources and the magnitude of magnetic field vary rapidly. It is believed that these rapid variations may lead to the release of significant amounts of energy which contributes to the corona heating. Near the foots of polar plumes small-scale jets were discovered. Earlier such jets were observed only in the active regions of the Sun.

Based on the SOHO data researchers hope to better understand the magnetohydrodynamic processes beneath the visible surface of the Sun. One of chief aims of the project was also to see if plumes can be positively identified as the sources of high-speed streams of solar wind that were observed by spacecrafts.

Source: http://www.nasa.gov

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