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Physics news on the Internet (based on electronic preprints)

1. Neutrino oscillations

Compelling evidence for neutrino oscillation, i.e., the mutual transformation of different neutrino species, was reported at the Neutrino 98 conference in Japan based on neutrino detection experiments at the underground Super-Kamiokande facility. This latter, a huge steel tank 41 m in height and 38 m in diameter, is filled with pure water and has thousands of photodetectors mounted on its inner surface. Neutrinos produced by cosmic rays hitting the upper atmosphere were studied by detecting the Cherenkov radiation from electrons and muons they scatter. The existence of neutrino oscillations established from several thousands of such events implies that the neutrino mass is nonzero and differs for different neutrino species. A nonzero neutrino mass is predicted by most Great Unification theories, in which the weak, electromagnetic, and strong interactions are united. While the experiment yields a difference between the electron and muon neutrino masses (0.07 eV), the mass itself still remains undetermined. The oscillation phenomenon may perhaps account for the shortfall of neutrinos from the Sun. The implications of a finite neutrino mass for the formation of the universe's large- scale structure are pointed out.

Source: http://www.phys.hawaii.edu:80/jgl/nuosc_story.html

2. Search for the magnetic monopole

Magnetic monopoles, hypothetical magnetically charged particles, are being searched for at Fermilab in the same proton-antiproton collision data used to discover the top quark. While the monopole itself has not yet been found, a lower limit on its mass is established, which is 600 or 900 GeV depending on the spin.

Source: *Physics News Update*, Number 375
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT

3. Ultracool atoms in a quantum cavity

A Caltech group reports a study of a single atom – single photon quantum system in a small mirror-walled cavity capable of trapping photons of certain frequencies. The atoms used were those of cesium cooled down to 20 μK using a magneto-optic trap. A beam of such ultracool atoms, when combined with very weak laser radiation, ensures that only one atom and one photon are in the cavity at any given moment. Interestingly, the system's resonance curve is asymmetric with respect to the central frequency — presumably because the nature of the atom-cavity interaction changes from repulsion to attraction as the photon frequency is detuned blue or red, respectively.

Source: http://publish.aps.org/FOCUS/

4. A bright quasar

A new quasar was discovered by G Lewis and his colleagues using the 2.5-m Isaac Newton Telescope in the Canary Islands which is 10 times brighter than the most powerful quasars known. The quasar is about 11 billion light years from Earth (redshift is $z \approx 3.6$) and its emitted energy is shared about equally between the infrared and optical + UV ranges. It is not clear if the quasar's apparent brightness is actual or due to a gravitational magnifying lens along the line of sight. The first quasar was discovered by M Schmidt in 1963. Today, its high brightness is usually ascribed to an accretion disk surrounding supermassive black holes located in galactic nuclei.

Source: http://www.nature.com/

5. New class of star

A new class of star has been discovered for the first time in several decades by the 2MASS (Two-Micron All-Sky Survey) team under Dr. J D Kirkpatrick. In all, about 20 unusual infrared sources (named L dwarfs) were found, whose spectral studies using the Keck II telescope at Hawaii showed them to be star-like objects differing dramatically in their features from ordinary stars. In particular, a surface temperature of only 1500 to 2000°C makes the objects all but invisible in the optical range. As their masses are only 6% of the solar mass, no stable fusion process is possible in their interiors.

Source: http://unisci.com/

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