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Physics news on the Internet (based on electronic preprints)

1. Antiproton studies

As another step in the search for possible particle-antiparticle differences, high precision measurements of the proton charge-to-mass ratio q/m were carried out at CERN by G Gabrielse and his colleagues. In this experiment, antiprotons produced in the accelerator were slowed down to a very low velocity and directed into an ion trap, after which the bending of their paths by the trap's magnetic field allowed the value of q/m to be obtained. This value was found to be within 9×10^{-11} of its proton counterpart, which is about an order-of-magnitude improvement over previous results. A new proton-antiproton asymmetry, if discovered, would have far-reaching implications for the theory of elementary particles.

Source: http://ojps.aip.org/prlo/top.html

2. Multiple states of Rydberg atoms

P Bucksbaum, of the University of Michigan, and his colleagues were able to place a highly excited Rydberg atom into many quantum states simultaneously by employing very short duration laser pulses. When absorbed by an atom, such a pulse, a superposition of electromagnetic waves of different frequencies, transforms into a superposition of the quantum states of atomic electrons. In a Rydberg state, an electron is not an 'electron cloud' surrounding the nucleus but rather a wavepacket circling the nucleus like a planet around a star. Applying a series of pulses can create a number of wavepackets that interfere with each other. The effect is of interest for the design of quantum computers: even today, several bits of information can already be stored using a single Rydberg atom.

Source: *Physics News Update*, Number 429
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT

3. Development of roughness in the atom deposition process

A Dutch research team led by S van Dijken have used copper as an example material to study the formation of roughness during the deposition of atoms on a surface. However smooth a surface may look, the presence of protruding islands of atoms always makes it rough on the atomic scale. These islands electrostatically affect and attract the atoms being deposited, thus increasing the already existing microscopic roughness. The phenomenon has possible applications in novel molecule-sized structures with tailored properties.

Source: *Physics News Update*, Number 428
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT

4. Distant radio galaxy

A radio galaxy is a source of powerful radio waves typically generated, by a synchronous mechanism, in two gas clouds, 10 to 100 kpc from the galaxy's centre, which are due to energy release from the galaxy's core. In the course of a systematic search for distant galaxies among ultra-steep spectrum sources, the most distant galaxy known has been discovered using the Keck II telescope. Experience shows that the larger a galaxy's (absolute) spectral index, the higher its luminosity and hence the easier its discovery. Keck II images made in the infrared showed the new galaxy to have an emission line Lyα shifted towards the IR range because of the expansion of the Universe. The value of the galaxy's redshift is found to be $z = 5.19$. The galaxy's radio emission that now reaches the Earth was produced when the galaxy was no more than one tenth its present age.

Source: http://xxx.lanl.gov/abs/astro-ph/9904272

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