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Physics news on the Internet (based on electronic preprints)

1. Nobelium-254P

Atoms with atomic numbers above 92 (trans-uranian elements) are all but absent in nature. Researchers at Argonne National Laboratory have produced heavy atoms by directing calcium nuclei at a lead target in the ATLAS accelerator. In this process a small fraction of nobelium-254 is obtained, whose nucleus consists of 102 protons and 152 neutrons and has a relatively long lifetime of 55 sec. The nuclei are created within a so-called 'Gamma sphere,' a spherically shaped device lined by gamma detectors which sample gamma photons from newly created, highly excited and spinning nuclei. Having passed a mass analyzer, the nuclei go to a silicon detector, to be identified by the way they decay into lighter fragments. Nobelium-254 is the heaviest nucleus whose gamma spectrum has been studied in detail so far. A 20% non-sphericity of the nucleus is reported, and the possibility for this heavy nucleus to sustain an angular moment of $\approx 14\hbar$ is shown.

Source: *Physics News Update*, Number 397
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT

2. Electron diffraction on a fullerene

A Solov'ev and his colleagues in St. Petersburg have developed a new technique for the study of large molecules and atomic clusters by means of electron diffraction. Using a 809 eV electron beam, a gas of spherical C_{60} fullerenes was investigated. The effective electron wavelength was chosen to be smaller than the size of the fullerene molecule but larger than the intercarbon atom spacing. The angular and energy distributions of the scattered electrons were studied. The technique proved very useful for the study of the molecule's surface electrons. In particular, a number of plasmon modes were detected, of which only one had been previously reported. In the authors' opinion, in such experiments the surface charge distribution and polarizability of the C_{60} molecule as well as the properties of more complex molecules, e.g., proteins, can also be examined.

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

3. Photon molecule

In 1997, A Forchel, T Reinecke and their colleagues created a 'photonic atom,' a quantum system consisting of a single photon in a micron-size semiconductor cavity. By connecting two such 'atoms' by a microscopic bridge, a 'photonic molecule' was obtained in more recent experiments. As is the case with the hydrogen molecule, the energy levels of the photonic molecule are observed to shift and split. The 'photonic molecule' is the first step towards the creation of more complex structures of a larger number of 'photonic atoms,' to which desired properties may be given.

Source: http://ojps.aip.org/prlo/top.html
Physical Review Letters, 21 September 1998

4. Gamma ray burst

On August 27, 1998, for the first time, significant changes in the Earth's ionosphere were detected, caused by an energy flow from outside of the solar system. A 5-min high-power burst of gamma radiation caused an effect comparable to oscillations normally observed during a day in ionospheric activities. The phenomenon caused a partial interruption of radio communication. A similar situation is observed during solar blasts. A burst of gamma and X-ray radiation was also detected by a number of space vehicles. The radiation source is believed to be a neutron star which was detected earlier due to its pulsed X-ray radiation. Such neutron stars are called magnetars due to their high magnetic fields of 10^{15} G, 100 times that in ordinary neutron stars. The burst presumably occurred during a fault in the neutron star's core which caused charged particles to accelerate in the magnetic field.

Source: http://unisci.com/

5. Distant galaxies

Extremely weak galaxies about 12×10^9 light years away have been detected using an infrared chamber and a multi-object spectrometer mounted on the Hubble telescope. The large red shift due to the expansion of the Universe make these galaxies invisible in the optical range. Some galaxies have blue colored knots in their structure, which were earlier considered as separate galaxies but turned out to be in fact regions of active star formation. Possibly, the detected galaxies are still in very early stages of their formation. A new generation telescope, to be launched in 2007, seems to hold particular promise for progress in the study of such objects.

Source: http://www.stsci.edu/

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