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1. Nanobelts

A new type of nanostructure, dubbed a nanobelt, has been created at the Georgia Institute of Technology in the USA. Such structures, of typical size 15 nm $\times$ 100 nm $\times$ 100 μm, consist of the oxides of zinc, tin and other metals and are obtained from powdered oxides by first evaporating and then rapidly cooling them. The nanobelts have a wealth of interesting properties. The electrical resistance of zinc- and tin-oxide-based belts changes dramatically when they come in contact with gases and liquids. Fluoride-doped tin oxide nanobelts change their resistance when exposed to IR radiation. Nanobelts of tin-doped indium oxide are good electrical conductors and in addition are transparent to optical wavelengths. The nanobelts, along with carbon nanotubes, may prove useful for microelectronics applications.

Source: *Science* **291** 1947 (2001)
http://www.science.com

2. A Λ particle in a nucleus

Lithium isotopes with a Λ particle substituted for one of the neutrons have been obtained by K Tanida's group at the University of Tokyo (a Λ particle is a baryon consisting of u, d, and s quarks). The isotopes were created by bombarding a lithium target with a beam of pions. To detect the radiation emitted by nuclei undergoing transitions from excited states to the underground state, highly sensitive detectors were used. Based on the fact that the lifetime of an excited state is strongly dependent on the size of the nucleus, it was found that the new isotopic nuclei are much more compact than normal ones. This property, predicted back in 1983, is due to the fact that a Λ particle in a nucleus is immune from Pauli's exclusion principle and, unlike a neutron, requires no additional space for its accommodation in the nucleus. It penetrates to the center of the nucleus and attracts all the remaining nucleons — hence the reduced size of the nucleus.

Source: *Phys. Rev. Lett.* **86** 1982 (2001)
http://prl.aps.org

3. A superconducting polymer

Superconductivity in a polymer, specifically at 2.35 K, has been observed for the first time by B Battlong and his colleagues at Bell Labs. Polymers are composed of long, threadlike carbon-based molecules, and the particular systems studied in the Bell Lab experiment were thin films consisting of alternate crystalline and amorphous polymer regions. Using an FET-like device, electrons were injected into the films. The new superconductors exhibit properties analogous to those of their polycrystalline counterparts — in particular, superconductivity in them is found to disappear in the presence of a strong magnetic field. The mechanism of superconductivity in polymers is not yet clear.

Source: *Physics News Update*, Number 529
http://www.aip.org/physnews/update/

4. New type of quasar

Using optical data from the VLT (Very Large Telescope in New Mexico) and X-ray data from the Chandra Observatory, a type II quasar has been found in the constellation Fornax — for the first time. Such objects were first predicted in the early 1980s based on a unified model describing quasars and active galactic cores. Unlike its type I counterparts, the newly discovered quasar is obscured by a cloud of dust and gas, which reduces the quasar's optical brightness but is essentially transparent to X-ray radiation. Most likely, both types of quasar are powered by accretion of matter onto a supermassive black hole. Type II quasars might be just normal type I quasars still in the earliest stage of their evolution. Because type II quasars are difficult to identify, the question of their abundance remains to be answered.

Source: http://xxx.lanl.gov/abs/astro-ph/0103198

5. Radio emission from a brown dwarf

For the first time, astronomers using the VLA radio telescope have been able to detect radio emission from a brown dwarf. Brown dwarfs are celestial bodies whose masses are intermediate between those of stars and giant planets and whose temperatures are too low to allow self-sustaining thermonuclear reactions. The radio waves are believed to be emitted by the electron synchrotron mechanism involving a brown dwarf atmosphere's magnetic fields. In the upper atmosphere, or corona, the energy of the electrons is transformed into X-ray radiation, which has also been detected previously. While this model describes the intensities of radio and X-ray radiations in a unique way, the radio emission from the brown dwarf (known as LP944-20) is found to be 20,000 times stronger than predicted. This discrepancy may be due to the low intensity of the magnetic field in the atmosphere: electrons in a weak field are slower, emit more radio waves as they move, and are less effective in generating X-ray emission.

Source: *Nature* **410** 338 (2001)
http://www.nature.com
http://xxx.lanl.gov/abs/astro-ph/0102301

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