

Physics news on the Internet (based on electronic preprints)

1. Metallic hydrogen

At the APS March meeting in St. Louis, William Nellis informed that metallic hydrogen had been achieved at the Livermore National Laboratory. The principal possibility of metallic hydrogen existence was for the first time predicted by E. Wigner in 1935. Till recently it was believed that metallic hydrogen would presumably be created by compressing crystalline hydrogen obtained from a fluid phase. Solid, crystalline hydrogen was indeed obtained in diamond anvil cell at pressures of 2.5 Mbar, but without a transition to a metallic state. W. Nellis from the Livermore National Laboratory has succeeded in creating metallic hydrogen directly from liquid hydrogen under conditions of lesser pressure, of 1.4 Mbar. A gas gun was used to compress samples of liquid hydrogen. 1-inch-wide sample of metallic hydrogen was created, which is considerably larger than micron-size samples in the anvil experiments. The large size of the sample allowed for direct measurements of electric conductivity, unlike indirect optical measurements in anvil cell. In the metallic hydrogen created the gap between the highest filled electric energy level and the conductance zone was only 0.3 eV, which is comparable with the thermal energy. That is why hydrogen becomes a conductor. The formation and investigation of metallic hydrogen is of interest to astrophysicists since large planets like Jupiter and Saturn are expected to contain metallic hydrogen in their considerable part.

Source: http://www.aps.org

2. New chemical element

Element 112 with atomic mass 227 has been discovered at the GSI Laboratory in Darmstadt (Germany). Earlier elements 107–111 were created at the same laboratory. The technique used in experiments involved high-energy zinc atoms smashing into a lead target.

Source: http:// preprints.cern.ch/scan 9603 //html

3. New form of ice

The group of scientists from Germany, France and Italy predicted that a new form of ice can exist between 3 and 4 Mbar of pressure at room temperature. Previously 10 crystalline structures of ice were known, more that for any other simple substance. By modelling molecular dynamics scientists showed that in the new form of ice the oxygen atoms arrange themselves into a distorted hexagonal close-packed lattice. According to assumptions of numerous physicists, this ice may become metallic at high pressures. Nevertheless, as the investigation described shows, 'ice XI' is an insulator up to 7 Mbar. Under such pressures ice exists on Jupiter. The predicted form of ice will presumably be discovered in diamond anvil cells at achieving pressures required.

Source: *Physics News Update*, No. 262 physnews@aip.org

Uspekhi Fizicheskikh Nauk **166** (5) 583 (1996)
Translated by S D Danilov

4. X-ray radiation of comet

X-ray radiation from a comet was registered for the first time on March 27, 1996 in observations of the Hyakutake comet from German orbital satellite ROSAT. During the observations the comet was less than 17×10^6 km apart from Earth. The X-ray flux proved to be approximately 100 times stronger than was expected according to the most optimistic predictions. Besides, a variability in the flux at a characteristic temporal scale of several hours was discovered. Images obtained show that the radiation is coming from a serpent-like region on the lighted side of the comet.

According to one of preliminary theories, the Sun's X-ray radiation is absorbed by a cloud of water molecules around the comet nucleus and then re-emitted in the process of fluorescence. In compliance with that theory, the cloud is opaque to X-rays, so only the side oriented to Sun absorbs and re-emits. Another hypothesis states that the X-ray radiation is emitted due to the solar wind encounter with the comet material.

Source: http://www.nasa.gov

5. Observations of Pluto's surface

With the help of the Hubble Space Telescope astronomers have for the first time seen details on the surface of Pluto. The resolution of largest Earth-based telescopes was insufficient to carry out such measurements due to an extremely small angular size of the planet, which is $0.1''$. The surface was observed as the planet rotated through 6.4 day period around its axis. It turned out that Pluto's surface has many large-scale features. Among the planets with solid crust only Earth with its oceans and continents has greater large-scale contrast than Pluto. Bright and dark spots as well as dark stripes near the north pole are seen on the planet. The observed features are likely produced by the complex distribution of frosts consisting of hydrogen, carbon monoxide, and methane gases.

Source: http://www.nasa.gov