

Physics news on the Internet (based on electronic preprints)

1. Studies of sonoluminescence

The phenomenon of sonoluminescence lies in radiation of picosecond light pulses by gaseous bubbles in a liquid in a sound field. To date, several principally different theories have been suggested to explain this phenomenon [see *Uspekhi Fizicheskikh Nauk* **166** (6) 682 (*Physics Uspekhi* **39** (6) 650)], however its true reason is not established yet. Recent experiments have revealed a few new interesting facts. S Putterman with colleagues have discovered that light emitted by bubbles is of dipole structure, which points irrevocably to the anisotropy of the process of bubble collapse. According to K Weniger and his collaborators, the dipole radiation can persist for more than 100 periods of bubble oscillations. In order to explain these experiments, a group of scientists from the MIT and Marburg University have proposed a new theory for the interaction of a bubble with a sound field. It differs from all previous theories mostly in accounting for the process of acoustic energy accumulation over many periods of bubble oscillations. The light is emitted only after a considerable amount of energy is stored, but not during the first period of sound wave as was believed earlier. The scientists argue that the new theory successfully explains the dipole character of radiation.

Source: http://www.hep.net/documents/newsletters/newsletters.html
Physics News Update, No 288

2. News from the Lawrence Berkeley National Laboratory

1. Femtosecond X-ray pulses

The first directed X-ray beam of 300 fs duration has been produced at the Berkeley National Laboratory. The new source of radiation can be used to study motions of atoms in ultra-fast physical and chemical processes. A typical temporal scale of such processes is of the order of 100 fs at room temperature. Femtosecond pulses would make it possible, for example, to study motions of atoms during phase transitions between solid, liquid and gaseous states. Currently, it is planned to study the silicon fusion. X-rays are produced when powerful infrared laser pulses scatter on a narrow electron beam fed by a linear accelerator. The X-ray pulses are emitted along the direction of the electron beam. The electrons are then deflected by a magnet and what is left represents a pure X-ray beam. The researchers hope that this technique will allow them to obtain pulses with duration of less than 50 fs.

2. New source of ions

A new source of ions created at the Berkeley Laboratory can be helpful in improving the technology of manufacturing silicon-based semiconductor devices. In particular, this will lead to a better quality and a lower cost of flat-panel displays that have become popular recently. Earlier, to dope a layer of silicon with phosphorus a process called ion implantation was used in which beams consisting of a mixture of phosphine and hydrogen ions were employed. The presence of high-energy hydrogen ions led to some difficulties that made the process more involved and influenced the quality of silicon plates. Ka-Ngo Leung with collaborators have developed a method of selective ionisation of phosphine in which the hydrogen remains neutral. This improves the technology considerably.

Source: http://www.ibl.gov/Science-Articles/Research-News.html
Berkeley Lab Research News

3. Black hole in the Calaxy's centre

Direct measurements of the proper motion of stars in the vicinity of our Galaxy's centre gave new evidence for the existence of a black hole there. The measurement of star's radial velocity is carried out with the help of the Doppler effect and is usually an easy matter. A different situation arises with proper motions of stars. Their measurements at large distances require long observations. During five years researchers from the Max Planck Institute in Garching (Germany) were carrying out direct observations of the proper motions of 39 stars in the vicinity of the radio source Sagittarius A* located near the Galaxy's centre. It turned out that proper motions are as big as the radial ones. This suggests the presence of a dark object with a mass of $(2.43 \pm 0.4) \times 10^6$ solar masses at the Galaxy's centre. It may be either a single black hole or many black holes with smaller masses.

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

Composed by *Yu. Eroshenko*

Uspekhi Fizicheskikh Nauk **166** (11) 1230 (1996)
Translated by S D Danilov