

Physics news on the Internet (based on electronic preprints)

1. X-ray images

Conventional methods of obtaining X-ray images rely on absorption of X-ray radiation by irregularities of a sample subject to the analysis. With increasing the sample thickness one needs to use harder X-rays which possess a higher penetrating capability, and increase the intensity of X-rays to achieve a fairly good contrast. This may lead to changes in sample properties or even to the destruction of the sample, which restricts the applicability of the method. Other approach requiring considerably weaker radiation is based on detecting phase shifts of rays that passed through the sample. It is a common practice to use interference methods for measuring the phase shifts. K Nugent of the University of Melbourne in Australia and his colleagues suggested a new technique of phase measurements that does not need in interferometry. Their approach relies on investigation of changes in directions of X-rays as they pass through a sample. Information on these changes is converted into that on phase shifts which then serves for reconstruction of images. Using this new approach, the scientists have already achieved a resolution of 330 microns and hope to reach a resolution of about 1 micron.

Source: *Physics News Update*, No. 284
http://www.hep.net./documents/newsletters/newsletters.html

2. Formation of galaxies

With the help of the Hubble Space Telescope gigantic star clusters are discovered at cosmological distances. Seemingly they are predecessors and building material for newly formed galaxies. The observations were carried out during two days using the Wide Field Planetary Camera 2. A small fraction of the sky was explored in the northern part of the Hercules constellation. At a distance of 11×10^9 light-years measured by cosmological redshift of spectral lines, 18 objects were discovered which are gigantic, with size of 2000 light-years, star clusters. Each cluster contains about 10^9 young blue stars. All 18 clusters are localised in the region with dimension of about 2×10^6 light-years which approximately equals to the distance from our Galaxy to the Andromeda Nebula. So large concentration of clusters should lead to multiple collisions and mergers between them. And indeed, at least four of discovered clusters show binary structures in their centres. Observational data say in favour of so-called hierarchic scenario of the formation of Universe's structure: clusterisation of smaller objects into larger ones. An alternative scenario considers the fragmentation of large objects into smaller components. If the picture of galaxy formations due to merging is correct, then it would imply that old stars in the spherical subsystem of our Galaxy can be those from clusters that made up our Galaxy, while young stars of the disk formed later on.

Source: *NASA Press Releases*
http://www.hq.nasa.gov/office/pao/NewsRoom/releases.html

3. Rotation of Earth's core

Scientists at Columbia University have discovered that the Earth's inner core is rotating slightly faster (by one cycle per 400 years) than the planet itself. This conclusion was drawn based on measurements of propagation times of seismic waves caused by earthquakes. The inner core is composed of crystalline iron and its diameter is 2400 km. According to current views, it possesses an anisotropy with respect to sound propagation. There is a so-termed fast axis tilted by 10 degrees relative the North – South direction along which sound waves propagate fastest. Having examined data on 38 earthquakes occurred from 1967 to 1995 scientists noticed that the character of anisotropy changes with time. Most probably this could be explained by tilting of the fast axis and correspondingly by the rotation of the inner core relative to the Earth. The reason for that is perhaps the interaction with magnetic field of intense currents that flow in the core surface layer.

Source: *Physics Today*
http://aip.org/pt/phystoday.html

Composed by *Yu. Eroshenko*

Uspekhi Fizicheskikh Nauk **166** (10) 1094 (1996)
Translated by S D Danilov