

PACS number: **01.90.+g**

Physics news on the Internet (based on electronic preprints)

DOI: 10.1070/pu2000v043n05ABEH000811

1. Negative magnetic permeability

Back in the 1960s, V G Veselago of the P N Lebedev Physics Institute, in the then USSR, predicted theoretically that a material with both a negative electric permittivity and a negative magnetic permeability should exhibit unusual optical properties such as an anomalous Doppler effect, reverse Cherenkov radiation, and an inverse Snell effect (inverse light refraction at the boundary of a medium). While until now no materials have been known to have a negative magnetic permeability, Pendry and colleagues suggested some time ago that an assembly of microwires with a negative electric permittivity at microwave frequencies may realize this property when combined with an array of microscopic metallic rings with a negative magnetic permeability in the same frequency range. S Sheldon and D Smith of the University of California have now realized this idea by constructing a composite material made up of copper rings and copper wires mounted on a platform. When such a system is placed in an electromagnetic cavity, electric currents induced in the conductors give rise to negative magnetic permeability in the microwave range. Intriguingly, as an electromagnetic wave travels through such a material, the direction of its energy flow is opposite to that of the phase velocity. S Sheldon and D Smith are currently looking for other effects predicted by the Russian physicist. The new materials should have telecommunications applications — due, among other things, to their ability to focus radiation under conditions where normal substances disperse it.

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

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2. Electron microscope

A Japanese team has developed an electron microscope whose capabilities leave all existing instruments of this type far behind. The acceleration voltage used, about 10^6 V, is stabilized to 0.5 V, and the resolution power, about 0.5 A, is comparable with that of the scanning tunneling microscope. With its 60-pictures-per-second shooting rate, if has become possible to monitor certain physical processes. In this way, the motions of fine gold particles rapidly changing their shape have been studied. The study of vortices in high-temperature superconductors is another application that is being considered.

Source: *Physics News Update*, Number 478
http://www.hep.net/documents/newsletters/pnu/pnu.html#RECENT

3. Another class of gamma sources

The EGRET Telescope aboard the Compton Observatory has imaged 271 unidentified gamma ray sources in the Milky Way galaxy that shine continuously unlike gamma ray bursts. Of these, about 170 lie in the Galactic plane, so that whatever (if anything) they emit in other frequency ranges is invisible to the human eye because of the dust and gas clouds on the line of sight; they may, therefore - in principle - belong to one or another class of already known space objects. However, for the remaining sources, even though they are off the plane, it has so far been impossible to detect their emission at other frequencies and thus to identify them with known objects. This implies that either they represent a new type of object or, alternatively, that some unusual emission mechanism is at work. Hypotheses have been suggested that these sources are black holes producing jets of particles; or stars 10 to 20 times as massive as the Sun, whose star wind produces gamma radiation when interacting with interstellar matter; or else that rapidly spinning neutron stars with a strong magnetic field glow in the gamma range — an idea supported by the fact that the Geminga pulsar is detectable only in X-rays and gamma rays. The matter will hopefully be settled after the 2005 launch of the Gamma Ray Large Area Space Telescope (GLAST), 50 times as sensitive as EGRET.

Source: http://www.nasa.gov/

4. Solar cycle

A new solar cycle has emerged from the observations of solar sound waves by the SOHO spacecraft and the GONG chain of ground stations from May 1995 to November 1999. Methods similar to those used in seismology reveal that the sound waves are generated by solar material flows about one third of the solar radius beneath the Sun's surface which, surprisingly, show a periodicity of about 16 months. It is believed that there is a 'magnetic dynamo' region at that depth, in which the solar magnetic field is generated and with which the well-known 11-year solar cycle may be associated. Thus, the discovery of the 16-month cycle may help to unravel the origin of the 11-year solar cycle.

Source: http://wwwssl.msfc.nasa.gov/default.htm

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Uspekhi Fizicheskikh Nauk **170** (5) 552 (2000)
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