Astronomy

Dietrick E. Thomsen reports from Houston at the meeting of the American Astronomical Society

Tuning in on radio string

A group of theoretical physicists and astronomers proposes using radio astronomy to look for defects in the geometry and topology of the universe that are left over from a previous cosmological epoch. The defects are known as cosmic strings (SN: 5/12/84, p. 294). This group of theorizers – E. M. Chudnovsky of Kharkov in the USSR, George B. Field and David N. Spergel of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., and Alexander Vilenkin of Harvard University – suggests that cosmic strings may be at the heart of at least one recently discovered celestial radio source.

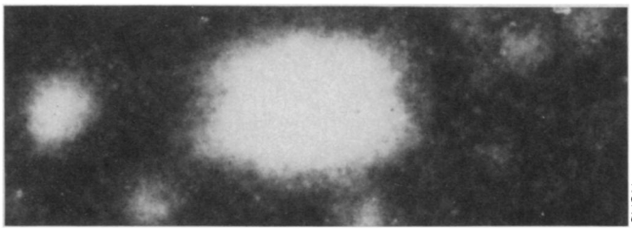
Certain recent cosmological theories propose that the universe went through one or more phase changes at certain crucial moments in its development. These phase changes are analogous to the sudden changes in the structures of substances when they freeze or melt. In the case of a universal phase change, it is not the arrangement of molecules or the bonds between them that change, but the geometrical characteristics of space and time themselves.

The cosmic phase changes are not uniform, however. They leave behind a few relics of the previous structure of space-time in the form of long, thin strings. These strings move through the new structure of space-time at speeds near that of light.

Strings can have electromagnetic effects. Under certain conditions they can emit radio waves. Chudnovsky and his collaborators suggest that such radio sources should have a string-like appearance. A recently discovered radio source, G357.7 −0.1, has such an appearance and this group suggests it may be made of cosmic strings. The suggestion is easy to prove or refute, they say: If G357.7−0.1 is made of strings, its filaments should move at nearly light speed, and that should be observable in a very short time.

Chile burger

Sorry, Herb, they're calling it "Gómez's Big Mac." Officially it's Object Gómez, a bun-shaped blob in the sky 3 seconds of arc by 5, discovered by Arturo Gómez of Cerro Tololo Inter-American Observatory near La Serena, Chile. Spectroscopic observations lead to the supposition that the object is a very old giant star that is just on the point of becoming a planetary nebula.



NOAO

Observations by Gómez and Maria Teresa Ruiz, José Maza and Claudio Anguita of the University of Chile at Santiago indicated that the object is a normal star somewhat warmer than the sun. But a Japanese visitor, Kimiaki Kawara, found a spectrum indicative of an object 10 times colder than a normal star. The picture now is that of a star with a cool thick ring of dust around its equator. The dust hides part of the star from view, giving the pinched-in appearance around the middle. The astronomers' "best guess" is that it is a star evolved past the giant or supergiant stage, undergoing a fast evolutionary phase that will make it a planetary nebula.

Astronomers know of a number of planetary nebulas, but until now they had never seen an example of this precursor stage, which may be as short as 1,000 years, a mere split second astronomically. If the "celestial hamburger" is that, it could prove a very important find.

Biotechnology

Electricity pills for the heart

Medical technology is making the diagnosis and treatment of heart ailments an easier pill to swallow. Researchers at the University of Michigan in Ann Arbor have developed a simple method of temporarily influencing the heart's natural pacemaker activity during diagnostic procedures or brief treatment of abnormal heart rate. The device is an electrocardiographic electrode sealed within a capsule and connected to a thin, insulated stainless steel line. Once swallowed, the electrode slides out of the capsule, allowing the physician to make an electrical connection with the esophageal wall – only 1 centimeter away from the left atrium of the heart. An electrical pulse lasting 10 to 30 seconds is then delivered, and the electrode is reeled in and recovered.

The device is used to induce heart stress during diagnostic imaging procedures in which the patient must lie very still, says Janice Jenkins, an electrical engineer at the University of Michigan. It is also being used to treat patients with abnormally high heart rate, a condition called tachycardia. In these people a brief electrical stimulation of the heart often slows heart rates. Previous methods of stimulating the heart's pacemaker activity have involved either surgically placing a catheter directly into the heart or delivering a large external jolt of electricity.

Two new crops in the biotech harvest

Biotechnology continues to provide biologists and medical researchers with crucial materials that are too scarce in the body to be isolated for laboratory study. This month, Integrated Genetics of Framingham, Mass., announced the successful production in bacteria of human protein C, an anticoagulant important in regulating the clotting process. And at the University of California at San Francisco (UCSF), scientists have used genetically engineered bacteria to produce apolipoprotein (apo-E), which is involved in cholesterol metabolism. The UCSF work was reported in the December (No. 24) PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

Protein C plays a key role in mediating blood clot formation and dissolution (SN: 1/26/85, p. 54). The protein both inactivates coagulation cofactors 5 and 8c and facilitates the breakdown of clots by stimulating tissue plasminogen activator (t-PA), a clot-dissolving substance. Integrated Genetics expects that protein C produced with genetic engineering will be useful for treating patients at risk of clotting problems due to acquired and congenital protein C deficiencies. The company also expects the protein to serve as an adjunct to t-PA for the treatment of cardiovascular patients. According to spokesperson Pat Connoy, the company plans to begin clinical evaluations of protein C in one year and hopes the protein will be available as a therapeutic agent in three years.

The recent production of apo-E by UCSF genetic engineering scientists in conjunction with Bio-Technology General Ltd. of Israel is expected to provide researchers with abundant quantities of the substance for studies of cholesterol metabolism. The apo-E protein facilitates the binding of cholesterol-carrying lipoproteins to receptors on the cell surface, speeding the removal of cholesterol from the blood.

According to Robert W. Mahley of UCSF, the cloning of apo-E protein could have two important consequences. Through a process called site-specific mutagenesis, amino acids within the protein can be changed; analysis of the altered protein would provide researchers with a better understanding of how apo-E interacts with cell receptors. Secondly, researchers can now infuse large quantities of apo-E into animals. Mahley speculates that this treatment may accelerate removal of cholesterol by the liver, and thus reduce the deposit of cholesterol on artery walls, lowering incidence of heart attacks.