Astronomy

Dietrick E. Thomsen reports from Chicago at the 13th Texas Symposium on Relativistic Astrophysics

News from the center of our galaxy

Astronomers and astrophysicists argue over what lies in the center of our Milky Way galaxy. They know that something that produces a lot of energy is there. Is it a black hole? Or a cluster of highly active stars? Or something else?

We can't see the center of our galaxy; it is obscured by dark clouds of dust. Our information comes from radio and, particularly, infrared observations, which generally have poor resolution, making it difficult to locate and separate small objects. Once every 18 years, lunar occultation gives observers an opportunity to sharpen the resolution. According to Eric E. Becklin of the University of Hawaii at Manoa, the first analyses of such an observing run, done last September, show in the galactic center a compact, bright infrared object, which astrophysicists do not yet know how to fit into their picture of the area.

The moon's motions in the sky follow an 18-year cycle called the Saros. Once during each 18-year period comes a series of months when the moon passes, once each month, through the constellation Sagittarius, and so between us and the center of the galaxy. That time is now, and in this cycle there will be eight opportunities to watch the moon occult, or pass in front of, the center of our galaxy, Becklin says.

As a result of millennia of observations, astronomers know very precisely where the moon is in the sky at any instant. The moon, lacking an atmosphere, has a very sharp edge. Thus, as it progressively cuts off radiation coming from behind it, astronomers can tell precisely the direction that radiation was coming from.

The September occultation, which is still being analyzed, revealed a compact object that astrophysicists had not been aware of. It's one of the warmer sources, Becklin says, being bright in the near infrared. It's compact, not a star, and almost too compact to be a cluster of stars. A group led by Charles Townes of the University of California at Berkeley speculates that the object has a large mass, which is typical of a black hole. Still, Becklin says, observers don't want to say at this point that there's a black hole there.

A satellite triangle for gravity waves

Gravity waves are the one major prediction of Einstein's general relativity theory that has not been directly detected or demonstrated by experimental equipment. These waves — gravity's analog to radio — are cyclic disturbances of gravitational forces generated by cosmic or astrophysical processes. Like radio waves, they propagate themselves through space.

The rather ambitious experimental effort now under way to find gravity waves may someday include an apparatus that shoots laser beams between spacecraft orbiting at distances of a million kilometers from each other. Kip Thorne of Caltech in Pasadena told the meeting that such an arrangement is under study at the Joint Institute for Laboratory Astrophysics (JILA) in Boulder, Colo.

The passage of gravity waves should produce minute vibrations or jiggles in heavy objects. One form of experimental detector is designed to reflect beams of laser light between two or more such objects and monitor their motions by changes in the phase relations of the light resulting from changes in the distances between them.

Experiments on earth use, or propose to use, distances between the weights from a few meters to kilometers. However, to detect what Thorne calls low-frequency gravity waves, those with oscillation periods between 10 seconds and 10 hours, one has to go into space. The suggestion under study at JILA would put up three satellites, two orbiting the earth and one the sun, spaced to form the vertices of a triangle with million-kilometer sides. This might be done by the year 2000, Thorne says.

Biology

Even skinny pigs lose heart

Researchers at the University of Wisconsin in Madison have identified a strain of pigs carrying mutant genes that code for three different plasma lipoproteins — molecules associated with elevated blood cholesterol and heart disease. The pigs develop heart disease as early as seven months of age, and die of heart problems within four years, according to a report in the Dec. 19 SCIENCE. Moreover, even low-fat, cholesterol-free diets did not stop premature development of heart disease. (In other types of pigs studied by the Wisconsin group, diet did affect the development of heart disease.) Therefore, they conclude, genes appear to be the determining factor.

Two models for inherited hypercholesterolemia and atherosclerosis in humans and rabbits already exist. Both, however, are based on defects in lipoprotein receptor activity. The newly described model in pigs rests on defects in the lipoprotein *structure*, although how structural changes cause heart disease was not determined. Tissue studies of the mutant pigs showed coronary atherosclerotic lesions similar in appearance to those found in humans. Even normal pigs can develop atherosclerosis between six and eight years of age, making the species a good model for studying human cardiac problems.

Trichinosis test in trials

Field trials are being conducted on an assay for trichinosis in pork, which may someday be used to screen for the approximately 90,000 hogs slaughtered each year in the United States that carry the parasite. The test kit — developed by Idetek, Inc., of San Bruno, Calif., and based on work done at the USDA's Agricultural Research Service in Beltsville, Md. — uses an antigen-antibody reaction.

Zoologist H. Ray Gamble of the Beltsville lab says the test can be performed without complicated laboratory equipment and is 95 percent accurate. Blood samples from the animals are assayed for antibodies to *Trichinella spiralis*, which can cause medical problems when people eat it in undercooked pork. According to Gamble, the test will not be commercially available until the field trials are completed.

Gamble says the latest figures on trichinosis show wide regional variation: In the Midwest, about one hog in 100,000 carries the parasite, but in the East, rates can be as high as one in 100. Illinois is one of the few places in the United States where state officials are allowed to destroy infected hogs.

Upping the agricultural ante

Two recent "firsts" in agricultural technology should improve yields for farms of the future:

• A biotechnology firm in Middleton, Wis., has announced that it successfully incorporated a bacterial gene into cotton, the first report of a genetic engineering success in cotton research. The gene, which codes for resistance to the antibiotic kanamycin, can serve as a research guide in the effort to improve cotton using recombinant DNA.

• Researchers at the University of California in Riverside and the state's Cooperative Extension Service have developed the first successful model to predict as much as two months in advance when citrus trees will blossom. Timing of bloom events is crucial to growers, because state law requires a "pesticide free" period each spring when farmers are prohibited from spraying chemicals on their citrus trees. The period — designed to save essential honeybee populations — begins when 10 percent of the citrus flowers are open and ends when 75 percent drop their petals. Prior to development of the model, which is based on temperature variations, growers often had only 72 hours' notice of the pesticide-free period. Individual growers can use the model in their own orchards. Inaccurate predictions in the past have cost growers millions of dollars in insect damage.