

Dietrick E. Thomsen reports from Crystal City, Va., at the meeting of the American Physical Society

Rattling WIMPs

Astronomers and physicists now have a number of interlocking reasons for believing that most of the universe — up to 90 percent — is made of matter that we can't see and that most likely is much more exotic than the stuff ordinary atoms are made of.

A candidate for the dark matter that is receiving a good deal of attention now among physicists is the class of hypothetical subatomic particles called WIMPs, or weakly interacting massive particles. Blas Cabrera of Stanford University has developed a new class of particle detector that uses the acoustical effects of passing WIMPs on solid crystals to determine their presence.

The existence of WIMPs has not yet been directly demonstrated. Cabrera's experiment is intended both to demonstrate their existence and to show that they inhabit the universe in sufficient numbers to do what cosmologists want them to do: namely, make the universe close on itself.

Up to now, detectors for subatomic particles have generally used either the particles' optical effects or electrical effects to determine their presence. WIMPs, being weakly interacting, almost never have these effects. However, WIMPs are massive — 10 or more times as heavy as a proton — so, as they pass through a crystal of silicon, they can give an electron or an atomic nucleus a bump from which it will recoil. The bump becomes a vibration, called a phonon, that rattles along the lattice of the crystal. At the face of the crystal, the phonon will strike a superconducting aluminum tunnel junction, which will record its presence.

Regenerating neutrinos

Neutrinos are another of the hard-to-detect particles of physics. They come in three varieties or "flavors": electron neutrinos, muon neutrinos and tau neutrinos. One of the questions before physicists in recent years is whether the flavor of a given neutrino is constant or whether it can oscillate from one flavor to another.

Neutrinos are made in the sun, in supernovas and presumably in other astrophysical events. The number of neutrinos from the sun that are detected on earth is only about a third of what the most widely accepted theory of the sun's energy-producing processes says there ought to be. To solve the discrepancy, some theorists have proposed that, as the neutrinos pass through the outer layers of the sun, conditions there trigger a massive flavor change. The one experiment now capable of detecting solar neutrinos, located in a mine near Lead, S.D., and operated by Raymond Davis of the University of Pennsylvania in Philadelphia, can detect only electron neutrinos.

Now come Anthony J. Baltz and Joseph Weneser of Brookhaven National Laboratory in Upton, N.Y., to complicate the matter further. They calculate that electron neutrinos that have been turned into muon neutrinos by their interactions with electrons on their way out of the sun could be turned back into electron neutrinos by similar interactions with electrons as they pass through the earth. This, Baltz told physicists at the meeting, could show up in the detectors as a day/night shutter effect.

In the daytime, a detector should record few regenerated electron neutrinos, but at night they have to pass through the bulk of the earth and so have more chances to regenerate before reaching the detector. Davis's experiment does not seem to show such a diurnal effect, but Baltz says he doubts it is sensitive enough.

He suggests that new experiments, which will look for lower-energy neutrinos than Davis's does, may be able to see the effect.

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World birth rate on the rise

Since the early 1970s, the world's birth rate has been declining fairly steadily. But last year, it took an upward swing from 27 to 28 births per 1,000 people, reports the Washington, D.C.-based Population Reference Bureau.

This increase is due solely to China, says bureau demographer Carl Haub. The Chinese, who account for one-fifth of the world's population, have recently relaxed their "one couple, one child" population policy. In addition, the number of women of child-bearing age in China is beginning to swell. Haub says demographers do not know which of these factors is more important. After stabilizing at about 18 births per 1,000 people, the Chinese birth rate jumped to 21 per 1,000 in 1986.

Haub says demographers have yet to make any population projections based on the assumption that China's birth rate will continue at this higher level. Projections assuming a lower Chinese birth rate suggest that the world population, which is expected to pass 5 billion this year, will plateau at about 10 billion in the middle of next century.

New rules on asbestos in schools

The Environmental Protection Agency (EPA) announced April 22 its proposed rules directing elementary and secondary school officials to have buildings inspected and asbestos hazards eliminated. Asbestos, which was used widely for insulation and fireproofing until the 1970s, has been shown to cause chronic lung disease and cancer. EPA developed the rules in accordance with the Asbestos Hazard Emergency Response Act passed last October. This fall, EPA will issue the final version of these proposed rules, which must be implemented by school districts by July 1989.

EPA's proposed rules are more stringent than its past guidelines, which only required school districts to inspect buildings and notify parents and school employees of their findings. And unlike previous regulations, which covered only asbestos in its "friable" (dry and easily pulverized) form, the new rules give guidelines for the treatment of nonfriable asbestos as well.

According to the new rules, school buildings can be occupied only if there is no more than 0.1 asbestos fiber per cubic centimeter in the air. The agency, which had estimated in 1984 that 45,000 schools contain asbestos, expects the cost of implementing the rules to be \$3.2 billion over 30 years; most of the funds will have to be raised by local sources.

Inert pesticide ingredients toxic, too

When one thinks of toxic pesticides, one usually thinks of the chemicals actively involved in killing pests. But there is increasing evidence that some inert ingredients, which serve as solvents and diluents, can be equally deadly, possibly contributing to cancer, birth defects and brain damage. Pesticide manufacturers, protecting their trade secrets, generally do not reveal the identity of these inert ingredients on their products' labels. And until recently, the EPA, which regulates the use of the active chemicals, had done little to regulate the inert ingredients.

But last month, the agency announced new policies aimed at controlling the use of some of the inert ingredients. EPA has identified 50 compounds, including benzene, chloroform, formaldehyde and dioxane, which it believes are of "significant toxicological concern." It has also compiled a list of 50 additional chemicals it believes are potentially toxic. EPA officials say manufacturers that do not find safer substitutes for these 100 compounds will now be required to identify the inert compounds on their product labels and to provide EPA with health data to help determine the conditions under which the compounds can be safely used.

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