

Astronomy

Dietrick E. Thomsen reports from Las Vegas, Nev., at the meeting of the American Astronomical Society

The cheesy universe

The moon is not made of green cheese, but the universe as a whole may look like Swiss cheese. That is the simile used by David Batuski and Jack Burns of the University of New Mexico in Albuquerque to describe the large scale structure that they and others are discovering. For decades cosmologists have believed in what they call the Cosmological Principle: That matter in the universe is evenly distributed, or to put it in the usual terms, that the universe is homogeneous and isotropic. The background microwave radiation that permeates the universe tends to confirm this. It is homogeneous and isotropic to a very high degree.

However, cosmologists have always known that there are small scale deviations from isotropy and homogeneity — individual galaxies and clusters of galaxies. Recent discoveries of voids, large volumes in which there are no galaxies, and filaments, long strings of galaxy clusters that seem to be associated with one another, would indicate, contrary to many previous opinions, that structure, that is, deviation from homogeneity and isotropy, extends to very large scales indeed. The Cosmological Principle now seems restricted to the very largest scale, perhaps that of the universe as a whole.

At the Las Vegas meeting Batuski and Burns reported what they call the largest such filament yet. It stretches more than 600 million light-years in the constellations Pisces and Cetus with galaxy clusters arranged like “beads on a string.” The next step, they say, is to see whether there is a string, some physical connection between the clusters and not just a chance association.

At the meeting, Joan Centrella of the University of Texas in Austin reported further on her work in computer simulation of the development of the universe (SN:10/29/83, p. 282). She and her associates take a hypothetical volume of space, distribute some matter in it and “turn on the force of gravity.” The computer code calculates what develops. What develops is just such filaments. Furthermore the time involved is not long enough for a cluster to have traveled very far along the string, she says, so the clusters are not influencing each other to form filaments — the filamentary structure is determined by something anterior to the formation of galaxy clusters. Centrella suggests it is a wavelike disturbance of the universe as a whole that appeared very early in history.

If the computer code is carried forward, the filaments become “pancakes,” flat two-dimensional structures that serve as boundaries for the voids. Thus the universe looks like a sponge or a Swiss cheese. These three astronomers agree that it would be 99 percent empty space with all the matter concentrated in the remaining one percent.

Dust around the sun

There's a lot of dust in the universe. Clouds of it pervade interstellar space in our own and other galaxies. A lot of it is also present in our solar system. Some of that dust forms a ring around the sun.

The solar dust ring was first discovered in 1967. It was rediscovered during the solar eclipse of June 11, 1983, by a group led by Shizo Isobe of the University of Tokyo. (SN: 10/29/83, p. 277). At the meeting Isobe reported that balloon-borne equipment flown with the help of the Indonesian space and aeronautic agency detected the rings at eight visible and infrared wavelengths. The observation has to be done during a total eclipse as nothing so near the sun is visible at any other time.

These observations confirm that there is a condensed, highly structured dust ring surrounding the sun with a radius four times that of the sun (that is, about 2 million kilometers from the solar surface). Measurements of the polarization of the radiation indicate that the main component is refractory grains such as silicates. Preliminary estimates indicate the total mass in the rings is millions of tons, and their temperature is 1,300 kelvin.

Environment

EDB—scare over treated foods spreads

Recently the Environmental Protection Agency (EPA) enacted an emergency ban on use of ethylene dibromide (EDB) as a soil fumigant to control nematodes (SN: 10/8/83, p. 229), and a phasing out of the chemical's other pesticide applications. Fumigating stored grain, for example, ended Oct. 30; citrus fruits may be treated through September of this year. However, concern that the chemical—now believed to be a potent human mutagen and carcinogen — may have found its way into foodstuffs, has prompted several states to test for that. And a disturbing number of these tests have proven positive.

At last count, Florida had recalled 77 brand-name grain-based products after samples of those foods showed detectable levels of EDB—one part per billion (ppb) or more. At present, it is not known at what level EDB in food might be hazardous, and EPA has set no limits on permissible levels in foods. But pressure is growing, both within EPA and state governments, to have such limits set. If every state took Florida's approach and banned sale of foods contaminated with 1 ppb or more, billions of bushels of grains, processed foods and raw produce might have to be destroyed — a prospect panicking food wholesalers and retailers alike. Already California has banned importation of citrus fruits treated with EDB; some the state tested from Mexico showed contamination as high as 1,200 ppb.

Officials from EPA and the Agriculture Department are currently considering whether to ban immediately EDB's remaining pesticide uses and whether to regulate EDB levels in food.

Anorexia dioxin: A matter of hormones

Changes in hormone production and sex organ weight may help explain how dioxin causes its toxic effect. Rats fed high doses of dioxin immediately cut back on their food intake and eventually die, apparently of starvation. Robert W. Moore and Richard E. Peterson of the University of Wisconsin in Madison suggest that dioxin might be acting on the endocrine system, altering the body's sense of “what is normal weight.”

Dioxin affects the male sex organs and their hormone production, conclude Moore and Peterson from experiments done in collaboration with Jerry A. Robinson of the Wisconsin Regional Primate Research Center in Madison. Rats fed high doses of dioxin had low levels of the male sex hormone testosterone and its active metabolite. The weights of their sex organs were also reduced. These changes were beyond what was attributable to simple loss of body weight, Moore says.

“These effects occurred in doses higher than those found in humans exposed to dioxin in ‘worst-case’ conditions such as industrial accidents,” Moore says. However, he added, “We simply don't know if humans and rats respond to dioxin to the same degree.”

Environmental briefs

- The Environmental Protection Agency (EPA) announced on Dec. 20 that it was initiating a 180-day review of data on the toxicity of 1,3-butadiene—a substance used in the manufacture of some synthetic rubber, plastics and latexes. Studies indicating that 1,3-butadiene causes cancer in both sexes of rats and mice have been reviewed and judged valid by scientists within EPA and the chemical industry. If the risk to humans posed by the chemical is judged significant, EPA must regulate exposure to it.
- EPA administrator William Ruckelshaus announced Jan. 13 that his agency would be initiating two major, long-term acid-deposition monitoring programs. The National Lakes Survey will look at 3,000 lakes in sensitive areas throughout the nation. Next year, a complementary national-forest survey will begin assessing impacts of the environmental scourge on terrestrial ecosystems.