Astronomy

Populating an astronomical void

One of the surprises of the last decade was the discovery of an enormous void — a hole in the sky — in the direction of the constellation Boötes. Although that region of the sky appears well populated with bright galaxies, careful distance measurements show that virtually all those bright objects are in either the foreground or the background, leaving a vast, apparently unoccupied region at intermediate distances (approximately 500 million light-years from Earth). More recent surveys of fainter sources in that direction now show the presence of a few dim galaxies within the void. Those surveys also provide a tantalizing hint that the distribution of the different types of galaxies found in the void may be somewhat different from the distribution found elsewhere.

"We know for sure that the Boötes void is not filled with big, bright galaxies like ours," says Robert P. Kirshner of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. "We're now investigating the possibility there might be a somewhat different population of galaxies in the void. It's possible that somehow the density [of galaxies] over a large region affects the kind of galaxies there are. That has interesting implications for the distribution of galaxies in the universe." Kirshner was a member of the team that first identified the Boötes void in 1981.

Data collected by the Infrared Astronomical Satellite (IRAS) have turned out to be useful for garnering information about occupants of the Boötes void. The satellite's instruments were particularly sensitive to infrared light, meaning they could detect emissions from galaxies obscured by dust. In such galaxies, dust tends to absorb visible light, subsequently reradiating the energy as infrared radiation.

In the latest analysis of IRAS data, presented at this week's meeting in Boston of the American Astronomical Society, Gregory D. Bothun and Gregory S. Aldering of the University of Michigan in Ann Arbor identify several more galaxies that lie within the void. Because the void is evidently a region of space with a below-average density of galaxies, and because earlier surveys have shown that the number of "IRAS" galaxies closely tracks the overall density of bright, ordinary galaxies, astronomers would have expected to find a noticeable deficiency in the number of IRAS galaxies. However, the new findings suggest there are as many such galaxies at the void's location as in randomly selected regions of the sky.

The results hint that low-density regions like the Boötes void may have a higher proportion of galaxies that have not yet converted all of their dust and gas into stars, indicating regions where star formation is still going on. Such galaxies generally tend to be dim, small in size and low in mass.

"On the other hand, we don't know those numbers very well," Kirshner says. "We don't really know what fraction of the galaxies we're seeing in these surveys." In other words, what's detected may be biased by the methods used to make the observations. "I think the question [of whether the galaxy types are different in voids] is still open," he says. "We need more data to get a better handle on it."

Observational studies of the galaxy population in low-density regions, or voids, provide useful data for astrophysicists trying to construct theoretical models of galaxy formation and the distribution of mass in the universe. The Boötes void is by far the largest of all known low-density regions. "It's the largest scale on which we know the structure," Kirshner says. "Everybody believes that if you look on the largest scale, the structure [of the universe] will even out and be homogeneous. But on the largest scale where we've actually done the work, we see striking inhomogeneities." Furthermore, he says, none of the present galaxy-formation models produces density contrasts as extensive or deep as what's observed.

Biomedicine

Smokeless cigarettes under fire

The "smokeless cigarette" may be all it's cracked up to be, and more. Research at the National Institute on Drug Abuse (NIDA) laboratory in Baltimore, Md., shows the "cigarettes" can be used to smoke crack, a highly addictive form of cocaine.

NIDA scientists Edward J. Cone and Jack E. Henningfield found they could alter a smokeless cigarette called Premier, manufactured by the R.J. Reynolds Tobacco Co. of Winston-Salem, N.C. Premier looks like a conventional cigarette but is actually a paper-covered tube containing a nicotine chamber and a charcoal heating tip. Smokers light the tip and draw hot air through the chamber, vaporizing the flavor chemicals and nicotine, which are inhaled into the lungs.

Cone and Henningfield emptied the nicotine-laden chemicals from the cigarette's chamber and packed it with 200 milligrams of crack. They then hooked these crack-loaded cigarettes up to smoking machines. They found that the machines got a dose of cocaine that would produce the "high" that crack users seek. They published their report as a letter in the Jan. 6 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

The NIDA researchers say they worry that R.J. Reynolds has given drug users an easy way to get their "high" in public. The crack-loaded Premier looks like a cigarette and would allow drug users to smoke crack without carrying cumbersome drug paraphernalia.

R.J. Reynolds spokesman Seth Moskowitz calls the NIDA research "ridiculous." He says Premier is marketed and designed to be a cigarette. "We think it is outrageous that government funds are being used to attack Premier," he says. R.J. Reynolds began test-marketing the product last October in St. Louis, Tucson and Phoenix.

The NIDA study adds fuel to a growing movement to ban Premier and other smokeless cigarettes (SN: 9/26/87, p.204). The American Medical Association and other health groups have petitioned the Food and Drug Administration to step in and regulate these devices. An FDA official says the matter may be put on hold until the Bush administration takes office.

Biochemical clues to muscular dystrophy

Israeli researchers have found two different forms of a protein whose absence appears to trigger Duchenne muscular dystrophy (DMD), a serious muscle-wasting disease that afflicts 1 in 3,500 male children. Their finding may help scientists explain why 30 percent of males with DMD suffer mental impairment.

The protein, called dystrophin, was identified in late 1987 by a Boston research team (SN: 1/2/88, p.4) led by Louis Kunkel of Harvard Medical School. It provided evidence that a lack of dystrophin starts a cascade of events leading to the characteristic muscle weakness of the disease. DMD is an inherited disease carried by women and passed down to sons. Affected males experience progressive muscle wasting and usually die in their 20s.

Uri Nudel and his colleagues at the Weizmann Institute of Science in Rehovot looked at normal rat tissue and found one kind of dystrophin in brain cells and another type in muscle cells. Their results, presented in a Jan. 5 letter to NATURE, suggest people with DMD who show mental retardation may have trouble producing the brain type of dystrophin, comments Donald S. Wood of the Muscular Dystrophy Association in New York City. While all boys with DMD lack muscle dystrophin, scientists theorize that a deficit of this protein in the brain may lead to retardation. Researchers have yet to learn dystrophin's exact role in the brain, Woods adds.

Ultimately, the new work may help researchers develop a treatment for the disorder. Any attempt to replace dystrophin would have to target both forms of the protein, Wood says.