Astronomy

Toward a smoother cosmic background

On Sept. 21, the last of the liquid helium aboard the Cosmic Background Explorer (COBE) spacecraft evaporated after 10 months of operation. As a result, one of the craft's three instruments can no longer take data. However, the remaining instruments continue to measure background radiation at a number of different wavelengths, and all three instruments have already generated tremendous amounts of valuable information.

"We have in hand a powerful data set," says Michael G. Hauser of the NASA Goddard Space Flight Center in Greenbelt, Md. COBE investigators now face the time-consuming task of analyzing the data. In particular, they need to account for all the factors that may have influenced the measurements – such as mirror vibrations and transient increases in antenna temperature caused by surprisingly intense auroras – to determine the data's true accuracy.

Designed to probe the earliest observable events in the universe, COBE instruments have produced a remarkable set of maps depicting the distribution of radiation at various wavelengths across the sky (SN: 4/21/90, p.245). New maps based on refined measurements still show no obvious signs of any fluctuations that would disturb the smoothness of the background radiation thought to be the remnant of the Big Bang, which started the universe's expansion. "You cannot see any features. It's surprisingly smooth," says George F. Smoot of the University of California, Berkeley.

Those measurements put stringent constraints on a number of proposed theories that attempt to account for how the universe evolved to its present, lumpy state of galaxies and supergalaxies (SN: 3/24/90, p.184). The data already seem to rule out several possibilities. Researchers explored the implications of the COBE results last month at an astrophysics meeting in College Park, Md.

Galaxies far and wide

By carefully recording the faint light surrounding a bright galaxy at the center of a dense cluster, a team of astronomers has uncovered evidence for perhaps the largest and most luminous galaxy known. This gigantic agglomeration of stars, which sits at the center of a rich galaxy cluster called Abell 2029, extends 6 million light-years in diameter (more than 60 times the width of the Milky Way) and emits more than a quarter of all the light produced by the entire cluster. Juan M. Uson of the National Radio Astronomy Observatory in Socorro, N.M., and his colleagues describe their discovery in the Oct. 26 SCIENCE.

"The central galaxy in Abell 2029 is remarkable for its size as well as the uniformity of its structure," they report. "Both of these characteristics suggest that its birth must have occurred during the initial formation of the cluster."

At the same time, astronomers working at the European Southern Observatory's La Silla telescope in Chile have discovered the most distant "normal" galaxy known so far. Now designated G 0102-190, this galaxy, which resembles the Milky Way, is so far away that the light detected by astronomers was emitted when the universe was only one-third as old as it is now. The galaxy appears surrounded by an extensive gaseous halo – a feature not usually found around nearby, "normal" galaxies.

The astronomers identified the extremely faint galaxy by looking for characteristic changes in the light spectra emitted by distant quasars. The gas in any galaxy that happens to fall on the same line of sight as a quasar would absorb certain wavelengths of light, allowing astronomers to estimate the distance to the intervening galaxy. The discovery of G 0102-190 provides valuable clues about the formation and evolution of galaxies in the early universe.

Biomedicine

Suicide brains: Naturally prone to pain?

Brain cells that mediate the perception of pleasure and pain in suicide victims differ markedly from the same cells in people who die of natural causes, a new study indicates. The findings support a hypothesis linking suicidal behavior with specific biochemical abnormalities in the brain.

Previous work showed that the brains of clinically depressed or suicidal individuals harbor abnormal levels of the brain chemicals serotonin and norepinephrine (SN: 10/14/89, p.248). The new work, by Ruth Gross-Isserof of the Weizmann Institute of Science in Rehovot, Israel, and Anat Biegon of the New York University School of Medicine in New York City, is the first to look at opioid receptors in suicide victims' brains. Opioid receptors reside on the surface of some brain cells and sop up tiny amounts of opium-like chemicals produced in the brain. They play critical roles in the sensations of well-being and physical and mental suffering.

The researchers measured opioid-receptor concentrations in 12 drug-free and disease-free suicide victims presumed to have been depressed before death. They found a 100 to 800 percent increase in the concentration of mu receptors (a type of opioid receptor) and a 50 percent decrease in another opioid receptor type called delta, compared with concentrations of those receptors in 12 people who had died of other causes.

Scientists know little about opioid-receptor types or the specific brain opioids to which each type responds, but the findings appear "very interesting," says David A. Baron, deputy clinical director of intramural research at the National Institute of Mental Health. "It makes good sense that there would be or should be an abnormality in the opioid system. You often hear from suicide patients that 'I couldn't take the pain anymore,' referring to physical or emotional pain," he says.

Indeed, Biegon adds, "we know people suffering from depression have a very high incidence of chronic pain. This may indicate a defect in the opioid system." Similarly, she says, "the essence of depression is anhedonia – an inability to experience pleasure. And opioid receptors are the primary targets of the brain's reward system."

Biegon says her study cannot answer the question of what causes the altered receptor concentrations in suicide victims' brains. Animal experiments indicate that opioid-receptor concentrations often increase in response to a lack of opioids, but environmental and genetic factors may affect receptor levels directly, she says. In upcoming experiments, Biegon hopes to use traceable antibodies directed against opioid proteins to direclty measure opioid concentrations in brains of live people with and without depression.

For now, she concludes, "I wouldn't say that changes in the opioid system cause depression. But it's very possible that they contribute to the syndrome."

Biegon presented the new findings in St. Louis last week at the annual meeting of the Society for Neuroscience. Details will appear in an upcoming issue of BRAIN RESEARCH.

Job market looks stable for undertakers

A new analysis of mortality statistics indicates that although U.S. life expectancy has risen dramatically in the past 100 years, it would take extremely large declines in death rates from cancer, heart disease and other degenerative syndromes to raise U.S. life expectancies much above the current average of about 75 years. Barring a major breakthrough in controlling the basic biology of aging, the average U.S. life expectancy won't exceed 90 years – even if scientists eliminate all circulatory diseases, cancer and diabetes, assert S. Jay Olshansky of the University of Chicago and his colleagues in the Nov. 2 SCIENCE. They conclude that researchers should concentrate their efforts on improving the quality, rather than the quantity, of life.