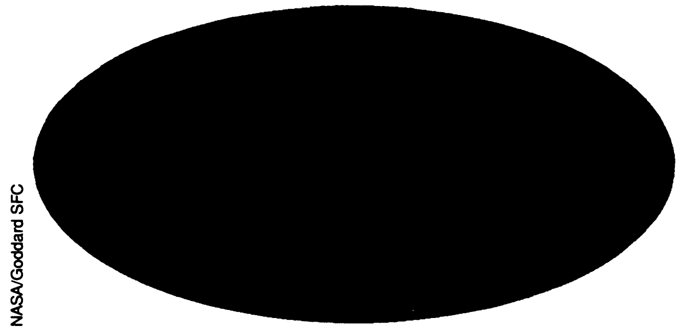
Maps sharpen view of cosmic radiation



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Hot (red) and cold (blue) spots show variations in the radiation left over from the Big Bang. With new data from COBE, areas at upper left and lower right probably represent true variations rather than noise.

Two new sky maps are giving astronomers their first direct glimpse of individual structures — gravitational ripples — in the primordial universe.

One of the new maps is a more accurate version of an earlier one that drew worldwide accolades when researchers presented it nearly two years ago. Based on the first year of data collected by NASA's Cosmic Background Explorer (COBE) satellite, this map showed tiny temperature fluctuations in the microwave background radiation believed left over from the explosive birth of the universe (SN: 5/2/92, p.292).

The pattern of hot and cold spots represents gravitational ripples in an otherwise smooth distribution of matter and energy in the infant universe. The ripples may have caused lumps to form there, ultimately creating clusters of galaxies. Though the overall pattern of hot and cold spots was statistically significant, the data contained about as much noise as signal. Thus, scientists could not identify any single feature as real.

Last week, at a meeting of the American Astronomical Society in Arlington, Va., the COBE team unveiled a new sky map based on an additional year of data. This distribution of hot and cold spots in the relic radiation has at least 1.4 times the amount of signal as noise, and some regions have about twice as much signal as noise, notes COBE researcher Charles L. Bennett of NASA's Goddard Space Flight Center in Greenbelt, Md. The added sensitivity means that some parts of the map probably show true structures in the microwave background, he says.

The new COBE-derived picture confirms that the tiny temperature variations were "not some fluke in the first year of data," Bennett says. Both maps show hot and cold spots that differ by 30 millionths of a kelvin from the 2.73-kelvin microwave background, but the new map halves the margin of error in this measurement. The team has two more years of COBE data to analyze; NASA ended the craft's mission last December.

Astronomers using radiotelescopes at Tenerife in the Canary Islands to study the microwave background over a small strip of sky also report actual structures in the relic radiation. Rodney D. Davies of the University of Manchester in England says the coldest and hottest spots in his team's map, which covers 10 percent of the sky, have about seven times as much signal as noise.

The group finds variations of about 42 millionths of a kelvin over patches of sky about half the angular size of that scanned by COBE. This agrees with published, first-year COBE maps, the team reports in the Jan. 27 NATURE.

Both the COBE and Tenerife maps reveal fluctuations that occurred a tiny fraction of a second after the birth of the universe. Davies says that as his group enlarges its sky coverage, it can begin to search for the particular features in these primordial fluctuations that are predicted by particular cosmological models. He cites, for example, a theory known as cosmic strings; it envisions sharp, filamentary structures in the background radiation.

In a commentary accompanying the NATURE article, cosmologist Joseph Silk of the University of California, Berkeley, notes that both maps weakly suggest that the curvature of the universe is such that the cosmos may expand forever rather than collapse in upon itself.

"Perhaps the curvature of the universe is imprinted on the sky," he writes. However, COBE researcher Edward L. Wright of the University of California, Los Angeles, says that without the ability to survey the microwave sky from another, distant galaxy, the hint of an open universe in the current maps may remain just that. *— R. Cowen*

Breast gene may slow the spread of cancer

Tumor suppressor genes earn their name because when they work right, they seem to keep cell growth in check. When they stop doing their job, cancer can develop. Such is the case with the p53 gene, which guards against a variety of cancers (SN: 11/27/93, p.356).

Now, geneticists have found a tumor suppressor gene that may play a role only in breast cancer. Known as the maspin gene because it codes for the protein maspin, this gene's activity — or rather inactivity — may forewarn of cancer on the brink of spreading, says Ruth Sager of Boston's Dana-Farber Cancer Institute.

Sager's team discovered the maspin gene by first searching for differences in the genetic material in normal and cancerous breast cells. The researchers uncovered more than 30 genes for which the transfer of protein-production messages either did not occur or occurred at very low levels.

Maspin closely resembles substances called protease inhibitors. These inhibitors attach to specific enzymes, rendering them incapable of breaking down their target proteins, says Sager.

She and her colleagues observed that maspin disappears from breast cancer cells grown in the laboratory. The same proved true when they examined samples of healthy and cancerous breast and lymph node tissues, as well as airway fluids from women whose breast cancer had spread to the lung, they report in the Jan. 28 SCIENCE. Healthy cells that line the breast ducts contained maspin, as did those cells near a tumor. Breast tumors that had not yet spread made very little maspin, and almost no maspin existed in tumor cells obtained from the lung and lymph nodes. In these cells, the gene remained intact but inactive, Sager notes.

To search for maspin, the scientists constructed pieces of the protein and from those pieces made antibodies that would recognize and attach to maspin. They tagged the antibodies and with them detected maspin in normal cells and in tumor cells into which they had injected an activated maspin gene.

They then put malignant tumor cells — some of which contained the activated maspin gene and some of which did not — into mice bred to accept cells from other species. The mice receiving cells with the maspin gene developed smaller and fewer tumors than mice injected with maspin-free cancer cells. None of the tumors in the first group of mice spread to other sites, indicating that maspin slows tumor growth and invasion, or metastasis, into other tissues. "[Maspin] seems to have quite an important effect in inhibiting the invasion process," says Sager.

"If you could upregulate [increase] maspin production, it's potentially a new therapeutic direction," comments William Stetler-Stevenson at the National Cancer Institute in Bethesda, Md.

It seems that maspin leaks out of cells, somehow making them less able to move away from the tumor site, says Sager.

Sager's group has tested 10 other tissues and found no active maspin gene, leading her to suspect that maspin works just in the breast. *— E. Pennisi*