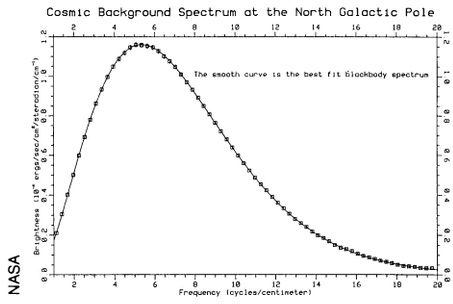
# Cosmic Evidence of a Smooth Beginning

Measurements of microwave and infrared radiation originating in the primordial universe show no trace of energy-releasing events that may have provided the "seeds" for galaxy formation, according to preliminary data from the Cosmic Background Explorer (COBE) spacecraft. The findings suggest an early universe surprisingly free of disturbances and irregularities, making it difficult to account for the origin of the giant clusters of galaxies, huge voids and other large features found in space.

"I'm completely mystified how the present-day structure [of the universe] has come to exist without having left some trace at the level of sensitivity that we know we have with our apparatus," says John C. Mather of the NASA Goddard Space Flight Center in Greenbelt, Md. "There should have been some kind of energy release [after the Big Bang]. But there isn't anything there." Mather and other members of the COBE team reported their initial findings last week in Arlington, Va., at an American Astronomical Society meeting.

Launched last Nov. 18, COBE represents the first space mission devoted to studying the origin of the universe. The spacecraft carries three instruments designed to map the sky at wavelengths ranging from 1 micron to 1 centimeter (SN: 10/28/89, p.279). Such measurements of celestial radiation provide a unique, composite portrait of the universe and its history.




*This plot, based on 9 minutes of data taken with COBE's infrared spectrometer, shows the remarkably close fit between the COBE measurements (boxes) and the theoretical curve for a blackbody at 2.735 kelvins.*

In its simplest form, the Big Bang theory asserts that the universe started out as an extremely dense, intensely hot fireball that has since expanded and cooled to its present size and state. About 300,000 years after the Big Bang, the universe was cool enough for atomic nuclei to combine with electrons to form atoms, allowing matter and radiation to evolve independently from that time on. That radiation is now observable as the cosmic microwave background — a faint, sky-filling glow with properties resembling those of an ideal heat source, called a blackbody, at a temperature of about 2.7 kelvins.

COBE's infrared spectrometer measures the intensity of this radiation at different wavelengths. Based on a small sample of data, the measurements so far show no deviations from a blackbody spectrum (see illustration).

"The [simple] Big Bang theory says there should be a blackbody and does not call for anything else," Mather says. "We see no deviation whatever from the blackbody curve."

The COBE findings appear to rule out the puzzling results of a 1987 rocket experiment that measured short-wavelength radiation intensities in excess of those for a perfect blackbody. "We do not find this excess at all," Mather says.

Using COBE's differential microwave radiometer, George F. Smoot of the University of California, Berkeley, and his team are checking the uniformity of the background radiation by mapping the sky at three different wavelengths. The COBE data so far indicate the early universe was remarkably uniform — at least 20 times smoother than the Earth's surface on a comparable scale.

"Any structure or geometry that was significant in the early universe would leave an imprint on the cosmic microwave background," Smoot says. "It's really hard to understand why we don't see something like the Andes when we do the map." In addition, Smoot's group failed to detect any distortions in the microwave background that would reveal that the universe itself spins on an axis.

COBE investigators also expect to complete a detailed infrared map of the sky to look for traces of a second background-radiation component: the light given off by the first luminous objects after matter started to collapse into clumps. "All radiation from such objects has been radiated into the void and has been propagating ever since," says Goddard's Michael G. Hauser. The trick is to separate this faint signal from the intense infrared sources in the neighborhood of Earth.

The COBE observations pose serious difficulties for theorists, who must reconcile a smooth, uniform Big Bang with a lumpy universe made up of galaxies distributed across space in gigantic bubbles, walls and other structures. Gravity by itself is too weak to draw matter together into the great structures now seen. Theorists are forced to postulate the existence of some hidden mechanism, such as cold dark matter, to initiate structure formation. But any such mechanism, if it exists, remains hidden.

*— I. Peterson*

## Oat bran is not special?

Since 1981, scientists have touted the cholesterol-lowering effects of soluble fiber — especially oat bran. But a Boston research team now asserts that experimental evidence of oat bran's benefits probably results more from reductions in dietary fat content than from concurrent fiber increases.

Frank M. Sacks and his colleagues at the Harvard University School of Medicine and Brigham and Women's Hospital gave specially prepared "supplements" — in the form of muffins and entrees — to 20 healthy hospital employees. For six weeks, half the group received high-fiber supplements containing oat bran while the rest received similar foods in which low-fiber Cream of Wheat and white flour replaced the oat bran. After a two-week break, the supplements were switched.

Neither diet affected blood pressure, and both lowered the volunteers' mean serum cholesterol to levels 7 to 7.5 percent below prestudy values. The researchers found "no significant difference" between diets in terms of changes in cholesterol and in the lipoproteins that transport cholesterol in the bloodstream. In the Jan. 18 NEW ENGLAND JOURNAL OF MEDICINE, they write that "oat bran has little inherent cholesterol-lowering action" in people with normal cholesterol levels — nor, apparently, in those with elevated levels, based on the limited range of values represented by this study group. People worried about serum cholesterol would probably benefit by increasing their intake of complex carbohydrates, "whatever the fiber content," the researchers conclude.

The subjects' low prestudy cholesterol levels (averaging a healthy 183 milligrams per deciliter of blood) provide the "simplest explanation" of why the Boston team found no difference between the two diets, maintains nutrition researcher David Kritchevsky of Philadelphia's Wistar Institute. Fiber seldom exerts much influence on serum cholesterol in people whose cholesterol levels are already low, he notes.

*— J. Raloff*