ASTROPHYSICS

Background Radiation and the Birth of the Universe

The report that earth is bathed with background radiation in the microwave range equally from all directions was received with more than a bit of skepticism when it was made in 1965. Since then, evidence has continued to accumulate that this radiation could really be electromagnetic waves emitted by the remnants of the primordial blast in which the universe was born.

The temperature of this radiation, detected then at only 4080 megacycles, was found to be slightly above three degrees Kelvin. It was, and is still found to be, close to this temperature from all observed regions in space. This lack of variation in direction, or isotropy, supports the theory that the radiation resulted from the debris still pervading the universe from the primeval fireball, a superdense concentration of radiation and matter.

Study of this cosmic microwave background is growing and, it is predicted in an editorial in the Nov. 25 NATURE, will grow further. NATURE helps the boom along with five reports in that issue alone on various aspects of the radiation.

Regardless of their effect on the theories of the birth and evolution of the universe, the flurry of research efforts is certain to provide a new tool for learning about its structure today, and more and more attention is sure to be paid to this background radio noise.

Until very recently, the science of cosmology was based on only one observational fact—other galaxies are moving away from the Milky Way at speeds that grow increasingly greater as the distance increases.

This observation was interpreted as evidence for opposing theories—the primordial cataclysm and the steady state. The latter holds that matter is being continuously replenished as it is destroyed, so that the total universe is apparently unchanged throughout the past, present and future.

One problem many scientists had with accepting the first Princeton University report of cosmic microwave background as residual radiation, in 1965, was that it had been detected at only one frequency. It could, therefore, have other origins than cosmic debris.

Observations would have to be made over a large frequency range in order to substantiate the original Princeton measurements of three degrees Kelvin as the temperature of this universe-pervading radiation.

Now that criterion is being met. Scientists have found that the background radiation from all over the universe is within three-tenths of a degree of this temperature and ranges from wavelengths of eight millimeters to ten centimeters. This range of frequencies substantiates the contention that the remains of the primordial mass radiate equally everywhere.

The hypothetical ideal object that absorbs all wavelengths of electromagnetic radiation and reflects none is termed a "black body." Such an ideal body also emits perfectly at all wavelengths, when it is heated; temperature determines wavelength of the emission.

As the range over which the background radiation intensity is being measured increases, it adds to the evidence that the electromagnetic spectrum corresponds to that of a black body.

Based on this, Drs. J. M. Stewart and D. W. Sciama of the University of Cambridge, England, believe measurements are now approaching sufficient accuracy over a large enough range that it should be possible to detect the velocity of the sun relative to this microwave background. They predict in NATURE that the radiation will seem to be the same everywhere in space only for an observer at rest.

Their theoretical calculations show that the motion of the solar system through the microwave background would result in an apparent change in temperature of the radiation from one direction to another. Drs. Stewart and Sciama state that future observations of the lack of isotropy of the cosmic microwave background are expected to reveal the solar system's velocity relative to distant matter.

Other related reports in the Nov. 25 NATURE:

- Drs. T. F. Howell and J. R. Shakeshaft of the Cavendish Laboratory, University of Cambridge, have found that at frequencies of 408 million cycles and 610 million cycles there is radiation "consistent with a black body spectrum of about three degrees Kelvin."
- Drs. R. C. Roeder and R. H. Chambers of the David Dunlap Observatory of the University of Toronto suggest that the black body radiation as so far observed could also describe a modified form of the universe that is alternately expanding and contracting. They call their model "cool," because the temperature of the radiation is always quite low.
- Dr. James E. Felton of the University of California, San Diego, finds that there is "no apparent contradiction between the observations of isotropic gamma rays and the assumption that the universe is filled with equilibrium black body radiation having a temperature about three degrees Kelvin at the present time." He refutes previous charges that the distribution of gamma rays is such that it conflicts with a residue of three degrees radiation, holding instead that the distribution favors it.
- Drs. E. K. Conklin and R. N. Bracewell of Stanford University's Radio Astronomy Institute in California have looked for small scale variations in the cosmic background radiation that would now be present if there had been small differences in density at the explosive instant of creation. They found no detectable differences.

L-ASPARAGINASE

Enzyme Starves Cancer Cells

The arsenal of anticancer drugs includes several compounds that kill malignant cells. Originally, scientists administered them singly or in sequence. Success improves, they have recently learned, when four drugs are given simultaneously in an all out bombardment of rapidly replicating cancer cells. But, no matter how they're given, available drugs can only slow, not stop, the course of cancer.

Though known compounds attack cancer cells, they also damage healthy ones, making it unsafe for physicians to give a patient doses sufficient to eliminate the destructive cells completely. Leukemia patients, for example, may carry a trillion leukemic cells. Today's drugs only wipe out somewhere between 10 million and 10 billion. This is a considerable number, enough to cause a remission of disease, but not enough to cure the patient. Remaining cells simply multiply and attack again.

Now, preliminary clinical trials of an enzyme that has undergone 14 years of test tube and animal experimentation show it to be useful in man. Testing it in 12 leukemia patients, New York scientists report a favorable response in six.

The enzyme, called L-asparaginase, distinguishes itself from known drugs by its ability to discriminate between cancerous and healthy cells. Its effect is highly specific, killing the former and leaving the latter untouched. L-asparaginase removes a protein-building amino acid known as asparagine from body fluids. Normal cells manufacture their own supply of this amino acid but cancer cells depend on the fluid as an external source. When L-asparaginase eliminates this supply, cancer cells starve.

"This is the first biochemical distinction between healthy and malignant cells," according to Dr. Lloyd J. Old of New York's Memorial Sloan-Kettering Cancer Center. "It may lead to further important biochemical distinctions," he predicts. And even though