

Cosmic Blackbody: Adding Another Twist

Fourteen years ago a discovery was made that revolutionized astronomy. A cosmic background radiation (CBR) was found to permeate the entire universe.

Why the excitement? The spectrum of the radiation had the look of a blackbody emitting at about 3° K. This was just the type of radiation predicted to be a remnant of the big bang. Astronomers quickly adopted the finding as clear evidence that our universe began with the explosion of a primordial egg about 20 billion years ago. The CBR, they said, was the last echo of that cosmic cataclysm.

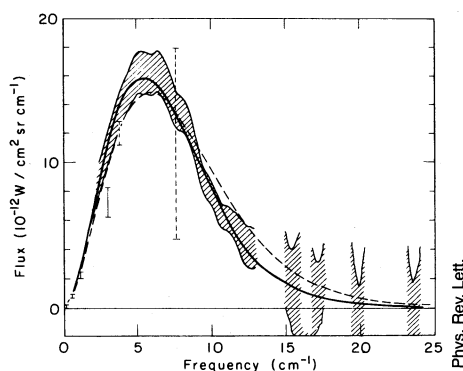
Ripples of concern went through the scientific community, however, when the most recent measurements of the background radiation did not totally conform to the spectrum of a 3° blackbody (SN: 4/21/79, p. 260). With the use of a balloon, David P. Woody, now with Caltech's Owens Valley Radio Observatory, and P. L. Richards of the Lawrence Berkeley Laboratory in California obtained the most accurate spectrum of the CBR to date—a spectrum with deviations. Their radiation measurements fell off the perfect blackbody curve in several places.

But now, three mathematicians from Massachusetts believe they have an explanation for the deviations. Ironically, their solution does not come out of the big bang theory but rather out of an opposing (and controversial) view of the origin of our universe—chronometric cosmology.

In the June 25 PHYSICAL REVIEW LETTERS, H. P. Jakobsen of Brandeis University, Mark Kon of Tufts University and I. E. Segal of MIT suggest that the photons that make up the background radiation have a total angular momentum large enough to produce an observable effect on the CBR. Such a "twist" is not incorporated into present theories and would have an appreciable effect only when applied on a cosmic scale.

With that in mind, the mathematicians modified Planck's law (the law that predicts the shape of a blackbody spectrum) to take this angular momentum into account. It became an added variable in determining the CBR's distribution of energy. They report that their adjusted law now provides a good fit to the spectrum observed by Woody and Richards.

The possibility that angular momentum might produce deviations in the CBR was actually brought out in Segal's chronometric cosmology several years ago. "I mentioned [angular momentum] to the big bang supporters years ago, but they didn't know how to work with it," Segal told SCIENCE NEWS. "The Woody-Richards experiments finally gave me a chance to bring it in. Until now, the deviations were not seen."



Shaded area is the CBR measured by Woody and Richards. Dashed line is pure blackbody curve. Solid line is blackbody spectrum modified by angular momentum.

This brings up a new question. How could an opponent of the big bang theory work on a problem that is considered to be the theory's greatest proof? "The cosmic background radiation is not uniquely indicative of a big bang," says Segal. "I don't believe the big bang has been substantiated. It requires many assumptions on how it began and how it cooled."

In place of the big bang, Segal envisions a closed, spherical universe that is both homogeneous and continuous in time. This means it is a nonexpanding, steady-state universe, a disturbing element to his critics.

An expanding universe is at the very crux of the big bang theory. Its supporters point to the shifting of spectral lines from distant galaxies toward the red end of the spectrum as proof that celestial objects are receding from us (just as a train whistle sounds lower as it moves away). Segal has another interpretation.

"In expanding universe theories, the photon is idealized as a plane wave. But this says its energy is infinite. It's unrigorous." To account for the redshift, Segal has developed alternative definitions for energy and time (hence the label chronometric) in a highly mathematical cosmology. As a photon travels from the far reaches of Segal's closed universe, it gets "delocalized." In other words, the photon spreads out to longer wavelengths. While the photon's apparent energy diminishes here in our local space-time, its total energy is conserved within the entire universe. We end up seeing a redshifted photon from a source that hasn't moved away due to an expansion.

To Segal, these "tired photons" (as they have been called) are the source of the cosmic background radiation. According to his theory, photons that have traveled around the universe several thousand times have completely redshifted and

have now achieved an equilibrium that follows Planck's law for a 3° blackbody (with angular momentum included).

It is conjectured that this angular momentum might explain how galaxies and solar systems get their spin as they evolve. The angular momentum would be imparted to the galaxies as they absorbed the photons.

The paper by Jakobsen, Kon and Segal was the first published attempt to explain the Woody-Richards deviations. Woody believes it is an unconventional approach. "My feeling is that people will be coming up with various ways to fit the data which are more conventional." Some theorists, for instance, believe there may have been physical processes going on in the early universe that degraded the blackbody from perfection. Only time will tell. □

Busy last week for FDA Commissioner

The first scientist-commissioner of the Food and Drug Administration left the agency June 29. Donald Kennedy is returning to Stanford University after two years of FDA service, including a final, particularly busy, last week. The FDA made several important decisions during Kennedy's last days as its director:

- The synthetic sex hormone DES was banned as a growth stimulating feed additive for cattle and sheep because residues left in the meat may cause cancer in consumers. Kennedy said that DES has been shown to cause cancer both in animals and in humans and that there is currently no way to detect the smallest, but possibly still cancer-causing, residues in meat. Although the FDA is not charged with considering economic effects, Kennedy said the ban's opponents have not demonstrated that it will have significant economic impact. A report of the Congressional Office of Technology Assessment recently estimated that the drug increased beef production by 3 percent (SN: 6/30/79, p. 422). The FDA says other drugs may be substituted for DES.

The FDA first issued a DES ban in 1972, but livestock and drug industries blocked it with court suits. Last September an FDA administrative law judge upheld the ban. The new FDA order states that DES use for animal growth promotion must stop by July 20. The hormone's use as a prescription drug is not affected.

- The limits on PCB's were tightened in fish, poultry and dairy products (see page 2).

- The FDA decided to prohibit sale of nonprescription drugs labeled as daytime

sedatives. The decision takes effect in six months. The daytime sedatives generally contain antihistamines, which make people drowsy, but the FDA says there is no evidence that drowsiness helps relieve anxiety. A few also contain scopolamine or bromide, which FDA considers unsafe or ineffective in sedatives.

- The most widely used color additive, Yellow No. 5, must be identified in the ingredient list on the labels of foods and drugs, according to an FDA ruling. Yellow No. 5, also called tartazine, is the first color required to be listed by name.

"Yellow No. 5 poses a particular hazard to some people, but is generally safe for use by the majority of the population. This requirement will enable those who are allergic to Yellow No. 5 to know which products contain it," Kennedy explains. The FDA estimates that as many as 100,000 persons in the United States are allergic to Yellow No. 5; most of those persons are also allergic to aspirin. The ruling takes effect June 26, 1980, for drugs and July 1, 1981, for foods.

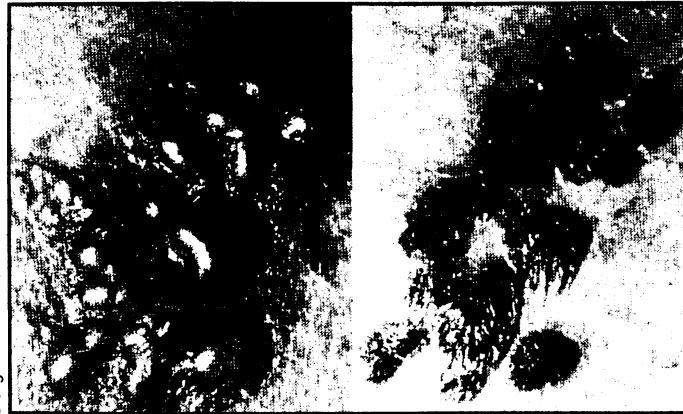
- The FDA proposed a requirement for prescription drugs to be packaged with a pamphlet of information to the patient. The pamphlet would describe proper use of the drug and any dangers and side effects. The agency plans to develop possible wording for the pamphlets for about 50 drugs initially and then to require manufacturers to develop and print the final package inserts. Agency officials expect preparing the written material for common tranquilizers and potent antibiotics to have top priority. They estimate it will take as long as 5 years before pamphlets will be included with most of the 375 basic drugs. The FDA already requires patient package inserts for IUD's, hearing aids, estrogens for menopausal women and birth control pills.

- As of July 1, labels of ice cream and most other frozen desserts must carry a list of ingredients. The desserts had previously been exempted from labeling rules on grounds that their ingredients were standard. The new regulation, proposed months ago, affects covered products sold in interstate commerce. □

Shuttle delay confirmed

The first orbital flight of the space shuttle had been scheduled for March, then June, then September of this year, and for several months the target has been Nov. 9, though even that date has drawn skepticism from inside and outside the National Aeronautics and Space Administration. Now the additional delay has become official, as NASA administrator Robert Frosch last week told the House Subcommittee on Space Science and Applications. There is only a 20 percent chance of a launch by the end of next March, he said, and he placed the probability of even an end-of-June launching at 50-50. □

A promising treatment for herpes



Genital herpesvirus sores (left) become dramatically smaller (right) after four days of two-deoxy-D-glucose therapy.

An Alabama allergist recently reported an unexpected yet promising form of treatment for genital herpes, a widespread venereal disease that currently has no cure and that can cause fetal death and may cause cervical cancer. The treatment was under-the-skin injections of commercially available flu vaccine (SN: 6/9/79, p. 375). Now another possibly even more effective treatment for genital herpes is reported in the June 29 *JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION* by Herbert A. Blough and Robert L. Giuntoli of the University of Pennsylvania School of Medicine in Philadelphia. It is an experimental drug called two-deoxy-D-glucose.

For 20 years this compound has been known to interfere with herpes virus multiplication in laboratory experiments. But no one had explored its antiviral activity clinically until Blough and Giuntoli did so. They selected 36 women with suspected genital herpes infections, proved by viral isolation or viral antibody studies that the patients truly had genital herpes, then gave half of the women two-deoxy-D-glucose topically or intravaginally and the other half a placebo for three weeks.

Patients with initial herpes infections treated with two-deoxy-D-glucose experienced rapid relief (within 12 to 72 hours) of genital pain and pain during urination, the two most common symptoms of female genital herpes. In patients who received the placebo, herpes symptoms lasted from eight to 10 days. Herpes lesions lasted about four days in patients given two-deoxy-D-glucose, but 15 days in patients given the placebo. The drug was similarly effective on patients with recurrent genital herpes.

During a two-year follow up, there were only two recurrences among patients with initial herpes infections treated by two-deoxy-D-glucose (an 89 percent cure rate). Among the two-deoxy-D-glucose-treated patients with recurrent infections, 90 percent showed improvement, such as less-frequent recurrences, fewer lesions or shortened duration of symptoms. None of the patients experienced adverse side effects from the drug.

"Two-deoxy-D-glucose provides a simple and unique approach to treatment of genital herpesvirus infections," Blough and Giuntoli conclude. Blough believes that the Food and Drug Administration might approve the drug for commercial use as early as a year or two from now. □

Winter life under the Arctic ice pack

As conventional sources of oil dry up, human beings are driven to increasingly remote, sometimes dangerous, regions of the earth in search of more crude petroleum. The Arctic ice pack is one of the areas being probed as a potential source of fossil fuels. But to whom—or what—would offshore oil and gas development there pose the greater danger: human or marine life?

Ocean experts have suspected that it is difficult, if not impossible, for undersea organisms to survive the winter months beneath the ice pack, when above-ice temperatures dive to minus 35 degrees F (with wind chill factors to minus 100) in near total darkness. Still, scientists know that some species do survive "because we would find them again every summer," says David Norton of the National Oceanic and Atmospheric Administration's Outer Continental Shelf Environmental Assessment Program (OCSEAP).

"But we figured that these stocks could only make it through the winter by retreating to deep, offshore waters in the fall," he says, "where they would not be bothered by the freezing downward of sea ice, or by the disruption from gouging of the seafloor by keels of moving sea ice." If this were so, oil and gas drillers on the ice pack would appear to have relatively few worries about adversely affecting marine life during the winter.

But a study team led by Norton now reports no such winter migration—on the contrary, the scientists found that some organisms not only remain but actually seem to thrive on the harsh winter condi-