physical sciences

COSMIC RAYS

Explanation for high-energy gammas

Last year Dr. W. L. Kraushaar and some associates reported that they had discovered an intense flux of high-energy gamma rays among the cosmic rays (SN: 12/7, p. 568). Attempts to explain the origin of these gamma rays in terms of other objects in interstellar space came up with numbers that were at least 10 times too small.

Now two papers in the March 17 PHYSICAL REVIEW LETTERS propose that the origin may be an intense infrared flux that was recently discovered in the galaxy (SN: 11/30, p. 543). The mechanism hypothesized is the so-called inverse Compton effect: Photons of the infrared would collide with high-energy electrons in the cosmic rays. The electrons would impart some of their energy to the photons, raising them from the relatively low-energy infrared to high-energy gamma rays.

If one figures on this basis, the numbers come out in accord with observation, say Drs. R. Cowsik and Yash Pal of the Tata Institute for Fundamental Research in Bombay in one paper and Dr. C. S. Shen of Purdue University in the other.

LASERS

Wind and laser beams

A continuous wave laser beam traveling through an absorbing medium such as air may be spread, distorted or deflected because temperature variations in the medium cause local variations of the refractive index. Drs. Frederick G. Gebhardt and David C. Smith of United Aircraft Research Laboratories in East Hartford, Conn., set out to discover what would happen to such a beam if a wind were blown across it in addition.

They used the beam from a carbon dioxide laser, shining through a mixture of air and propane. The effect of the wind, they report in the Jan. 15 APPLIED PHYSICS LETTERS, is to deflect the beam slightly into the wind for wind velocities ranging up to about 100 centimeters per second and to reduce the thermal distortion.

SUPERNOVAS

Gamma ray emission suggested

Remnants of type I supernovas should emit gamma rays at certain sharp frequencies: the gamma-ray line spectra. Drs. Donald D. Clayton of Rice University, Stirling A. Colgate of New Mexico Institute of Mining and Technology and Gerald J. Fishman of Rice have calculated the gamma ray luminosity of a typical remnant.

They started out by assuming that the optical luminosity of the remnant comes from the energy of the radioactive decay of nickel 56, which is expected to be the most abundant nucleus resulting from thermonuclear burning of silicon, a common element found in stars, under supernova shock conditions.

They find that the amount of nickel 56 necessary for the optical luminosity, 0.14 times the sun's mass, should give gamma-ray lines at energies of about one million electron volts, detectable in young supernova remnants at distances up to several million light years.

They suggest, in THE ASTROPHYSICAL JOURNAL for January, that future detectors aboard satellites should thus be able to detect one or two supernova events a year. A few remnants within our galaxy, they say, should be observable at all times in gamma-ray lines resulting from radioactive decay of another element found in supernovas, titanium 44.

PLANETARY ASTRONOMY

Venus atmosphere

Observations, both by space probe and from the ground, indicate that the atmosphere of Venus is hot and heavy with carbon dioxide. Dr. Robert F. Mueller of Goddard Space Flight Center suggests in SCIENCE for March 21 that the present Cytherean atmosphere was formed by chemical reactions involving rocks of the planet's surface.

Although the precise reactions have not been identified, he considers various reactions that produce carbon dioxide and concludes that a good theoretical case can be made for the same reactions that might have produced the carbon dioxide in the earth's atmosphere. The higher temperature of Venus would have permitted those reactions to produce more carbon dioxide there than they could on earth.

COSMIC RAYS

Low-energy protons

It is very difficult to estimate the number of low-energy charged cosmic rays that may exist in distant parts of the galaxy, because the solar wind and the interplanetary magnetic field alter the numbers that approach the earth. The validity of various methods of estimating from the flux of protons reaching the earth is in dispute.

Dr. D. W. Greenberg of the University of California, San Diego, suggests that direct radio observations of distant parts of the galaxy may help. The cosmic rays, he says, should ionize galactic hydrogen, and when the ions and electrons recombine, some of the energy they lose in the process should come off as radio waves.

PLANETARY ASTRONOMY

Carbon dioxide on Mars

Five astronomers have made a high resolution measurement of the carbon dioxide in the Martian atmosphere. Drs. N. P. Carleton and Ashok Sharma of the Smithsonian Astrophysical Observatory and Harvard University; R. M. Goody of Blue Hill Observatory and Harvard University; W. L. Liller of Harvard College Observatory and F. L. Roesler of the University of Wisconsin; observed absorption characteristic of carbon dioxide in sunlight reflected by the planet. They report in the ASTROPHYSICAL JOURNAL for January that the abundance of carbon dioxide in the Martian atmosphere is 83($\pm$ 8) thousandths of the earth's atmosphere. If carbon dioxide is taken to make up between 60 and 100 percent of the Martian atmosphere, as various judgments make it, then the atmospheric pressure on the planet's surface will be between six thousandths and nine thousandths of the earth's normal pressure.

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