astronomy

MOLECULAR ASTRONOMY

Nitrogen (II) oxide

A science that is called molecular astronomy has grown up in recent years from discoveries of radio emanations from clouds of chemical compounds in interstellar space (SN: 5/12, p. 351). These discoveries have stirred radio astronomers to study the possibilities of detection of all sorts of molecules that give off identifiable patterns of radiation in the radio range.

Fairly detailed discussions of most of these have been published, say Drs. I. N. Kotsev, G. I. Georgiev and V. M. Kontorovich of Kharkov University in the U.S.S.R., with a few exceptions, notably nitrogen (II) oxide (NO). But nitrogen (II) oxide, say the Ukrainian astronomers in Soviet Physics—Astronomy for May-June, "is apparently the only molecule having . . . transitions in the millimeter and centimeter ranges as well as in the decameter range of radio wavelengths."

They have therefore done a study of the possibility of detecting the molecule. They find three possible wavelengths: at 2 millimeters, 70 centimeters and 7 meters. The two longer wavelengths cannot be observed, they say, but the 2-millimeter signal might be seen if equipment could be made 10 times as sensitive as it is.

PULSARS

Nanosecond pulses not confirmed

Earlier this year Drs. N. A. Porter, D. M. Jennings and E. P. O'Mongain of University College, Dublin, reported that observations made from the island of Malta showed optical pulses coming from the Crab nebula. These coincided with the periods of both Crab pulsars, NP-0532 and NP-0537 (SN: 3/1, p. 207).

The duration of these pulses was only a few billionths of a second, about a millionth as long as the pulses seen by others from NP-0532 (SN: 2/1, p. 111).

Now Drs. Jared A. Anderson, Frank S. Crawford and David D. Cudaback of the University of California report, in the May 31 Nature, that they have searched for these nanosecond pulses and have not found them. Such short-lived pulses would have been difficult to explain on the basis of current theories.

COSMOLOGY

Earth's speed in the universe

The three-degree K. cosmic blackbody radiation that was discovered four years ago is usually taken to be a remnant of the cosmic fireball, the primeval explosion in which the universe was formed (SN: 6/15/68, p 577).

If it is that, it determines a frame of reference that is at rest with respect to the universe as a whole. A body at rest with respect to the universe should receive equal amounts of the blackbody radiation from all directions. If the body is moving with respect to the universe, the radiation should appear brighter in the direction in which the body is moving.

A number of past attempts to detect such an enhancement in the earth's case have yielded inconclusive results, but now a graduate student at the Radio Astronomy Institute of Stanford University, Edward K. Conklin, reports a definite positive result. In the June 7 Nature he reports a brightness enhancement of .0016 degree K. in the direction of the constellation Canes Venatici. From this he deduces a speed of 160 kilometers per second toward some point on the meridian of 13 hours right ascension. Determining the declination of the point will require further observations, he says.

PULSARS

Distances and numbers

Attempts to determine the distances to the pulsars have depended on the slowing of their signals by interstellar electrons. The slowing varies according to the frequency of the signal so that high-frequency pulsar signals that have encountered electrons should arrive sooner than low-frequency signals.

The amount of the lag depends on the number of electrons encountered, and if the density of interstellar electrons is known, the length that so many electrons would take up can be calculated. Past work has generally estimated the electron density at one in 10 cubic centimeters, but this, say Drs. A. J. R. Prentice and Dirk ter Haar of Oxford University, is probably too high and too rough.

They have done calculations in which they take account of the effects of interstellar hydrogen and hot stars on the electron density. They come up with distances for 28 pulsars ranging from about 500 to about 14,000 light years. In addition, they say in the June 7 Nature, if all pulsars are supernova remnants and all supernova remnants are pulsars, and if the estimated pulsar lifetime of 10 million years is true, then we are only seeing 10 percent of the existing pulsars.

SELENOGRAPHY

Non-homogeneous moon

Until the advent of lunar orbiting satellites information about the moon's physical shape and its gravitational field came from earthbound observations of its appearance and motions. Now the lunar orbiters provide direct information about how a test body responds to the moon's gravitation.

When data from the Soviet satellite Luna 10 are compared with older observations, says Dr. N. A. Chuikova of the Shternberg Astronomical Institute in Moscow, they lead to the conclusion that the moon's internal composition "certainly cannot be considered homogeneous."

This is determined by comparing the moon's actual surface with the so-called level surface, a surface determined by tracing out the points where the gravitational forces are equal to the average for the lunar surface. If the moon were a perfectly homogeneous sphere, the gravitational forces would be the same all over the surface, and the actual and level surfaces would coincide. In general this is not so, says Dr. Chuikova.

She goes on to say, in Soviet Physics—Astronomy for May-June, that there is evidence for a distince equatorial bulge on the side of the moon facing the earth. Here the physical surface rises 2,200 meters above a reference sphere with a radius of 1,738 kilometers.