physical sciences

GRAVITATION

Gravity waves and satellites

In June 1969 Dr. Joseph Weber of the University of Maryland reported the discovery of gravitational waves, energy-carrying waves that involve gravitational forces the same way that radio waves involve electric and magnetic forces (SN: 6/21/69, p. 593).

Dr. Weber's signals come in the form of short bursts from somewhere near the center of the galaxy.

Dr. Weber's records are made at a frequency of 1660 hertz. If these same bursts contain a low-frequency component, on the order of one cycle per minute (1/60 of a hertz), says Dr. Allen Joel Anderson of the University of Uppsala in Sweden, they should cause a perceptible wobble in the motion of bodies they encounter. If such a body is a space probe that is sending a continuous tracking signal to the earth, the effect of the wobble should show in the tracking signal.

Dr. Anderson studied the flight of Mariner 6 on March 15, 1969. There were records covering the times of four gravity-wave events reported by Dr. Weber. In connection with one of these, at 3:41 Greenwich Mean Time on March 15, 1969, "clearly something unusual happened" to the spacecraft's motion, says Dr. Anderson in the Feb. 19 NATURE.

He is continuing his experiment to see if he can find more instances that look like gravity-wave wobble. The determinations are difficult because the waves change the spacecraft velocity by less than 3 millimeters per second, resulting in a displacement of about 10 centimeters. The spacecraft was about 10 million kilometers from earth.

PULSARS

NP 0532's precursor pulse disappears

In spectra obtained in the radio range between frequencies of 195 and 430 megahertz, the Crab nebula pulsar, NP 0532, shows three pulses per cycle: a main pulse, an interpulse and a precursor pulse.

The precursor is unlike the other two: it has no correspondent in the optical spectrum of the pulsar, it is broader than the others and it is essentially 100 percent linearly polarized.

In ASTROPHYSICAL JOURNAL LETTERS for Feb. 1, Drs. J. M. Rankin of the University of Iowa, Carl Heiles of the University of California at Berkeley and J. M. Comella of the Arecibo Radio Observatory in Puerto Rico report another unique characteristic of the precursor: It disappears at frequencies between 430 and 606 megahertz.

They call this a surprise and cannot explain it.

ASTROPHYSICS

Another magnetic white dwarf

In 1970 Dr. James C. Kemp of the University of Oregon presented a theory of the emission of light by incandescent bodies in strong magnetic fields showing that the field would cause a small circular polarization of the light. The theory was developed to provide a way of finding magnetism in stars that have no prominent lines in their spectra.

At the same time Dr. Kemp and John B. Swedlund, also of the University of Oregon, announced the discovery of a white dwarf star with circular polarization and presumably a magnetic field of several million gauss (SN: 10/3/70, p. 290).

That discovery was confirmed by Drs. J. R. P. Angel of Columbia University and J. D. Landstreet of the University of Western Ontario. Now Drs. Angel and Landstreet report in the Feb. 15 ASTROPHYSICAL JOURNAL LETTERS that, working at the Catalina Station of the University of Arizona, they have found another. The star is called G195—19, and it is the ninth they have looked at since the original discovery. The amount of polarization is 0.42 plus or minus 0.04 percent, representing a magnetic field in the millions of gauss.

RADIO ASTRONOMY

Antares a radio source

Since the beginning of radio astronomy observers have tried to associate known sources of radio emission with visible objects. Although there are many correspondences among large or extremely powerful objects, galaxies, quasars and large gas clouds, many so-called radio stars have no optical counterpart and nearly all visible stars show no radio signals.

The sun is an ordinary visible star and a strong radio emitter, so astronomers reason that we do not record other visible stars because detectors are not sensitive enough.

With very sensitive detectors radio emission at 11.1 centimeters wavelength has been recorded from Antares, the brightest star in the constellation Scorpius, report Drs. C. M. Wade and R. M. Hjellming of the National Radio Astronomy Observatory at Green Bank, W. Va. in the Feb. 1 ASTROPHYSICAL JOURNAL LETTERS. Although radio signals have been reported or suspected from stars of peculiar character, this appears to be the first instance involving a star of relatively normal astrophysical nature.

ASTROPHYSICS

Sources of the cosmic rays

Various atomic nuclei appear among the cosmic rays. Comparing the abundances of these elements in the cosmic rays to their general abundances in the universe may tell something of the origin of the cosmic rays.

Dr. Ove Havnes of the Institute of Theoretical Astrophysics in Oslo points out in the Feb. 19 NATURE that the abundances of certain elements among the low-energy cosmic rays can be correlated with their first-ionization potentials, the amount of energy necessary to strip off the first electron.

Those with the lowest ionization potentials are overabundant; those with the highest ionization potentials, underabundant. This suggests, says Dr. Havnes, that these rays at least come from a region where singly ionized atoms are accelerated. Those with the lowest potentials would be most likely to be ionized and therefore come out most abundantly.

Dr. Havnes suggests either the shells of supernovas or the ionized hydrogen regions around magnetic Ap stars as possible sources.