physical sciences

PULSARS

Planets and glitches

On top of the general slowing of pulsar pulse rates, observations have shown three unusual occurrences.

One is a small up and down fluctuation of the pulsar NP 0532. The other two are sudden rises in the pulse rates of NP 0532 and PSR 0833, after which the downward trend resumed.

Some astronomers have interpreted the up-and-down variation of NP 0532 as the result of a planet orbiting the pulsar (SN: 10/25, p. 370).

Dr. F. Curtis Michel of Rice University suggests that the other two aberrations, called glitches, are also due to orbiting planets. He presents his arguments in the January ASTROPHYSICAL LETTERS.

Theorists hypothesize that a pulsar is formed when a star suddenly collapses and at the same time ejects some of its matter. If so, says Dr. Michel, the ejected matter should form a planet in a very ellipitical orbit with the pulsar in one end. Each time the planet passed close, the pulsar would speed up. Dr. Michel suggests watching for further glitches at regular intervals.

PLANETARY ASTRONOMY

Saturn's rings not ammonia

Three astronomers at the Lunar and Planetary Laboratory of the University of Arizona, Drs. Gerard P. Kuiper, Dale P. Cruikshank and Uwe Fink, now conclude that Saturn's rings are water ice and not solid ammonia as they reported last year (SN: 1/3, p. 20).

The three had been studying the infrared spectra of the rings and had found a pattern of absorptions around 1.5 microns wavelength that seemed to match the pattern of solid ammonia at about 75 degrees K. But later studies showed that ammonia did not match.

A search for further possibilities led them to discover that the spectrum of infrared light reflected by water ice changes with temperature, so that although the water ice spectrum at familiar temperatures did not match the rings, the water ice spectrum at about 83 degrees K does match.

PLANETARY ASTRONOMY

Venus clouds: no carbon suboxide

The atmosphere of the planet Venus contains thick clouds that completely obscure the planet's surface. One substance suggested as a possible main constituent of the clouds is carbon suboxide (C_3O_2). It was put forward because it might explain certain features of the clouds' infrared spectrum near 11 microns wavelength and also a slight yellowness that some observers see. Carbon suboxide can form a polymer that appears as a yellow, brown or red powder.

Drs. William T. Plummer and Robert K. Carson of the University of Massachusetts tested the suggestion by recording the infrared spectrum reflected by a carbon suboxide frost in the laboratory and comparing it with the spectrum of the Venus clouds. They report in the January ASTROPHYSICAL JOURNAL that neither the monomer nor the polymer form of carbon suboxide fits.

The monomer spectrum, they say, shows a sharp absorption at 2.7 microns wavelength that is absent from the cloud spectrum. The polymers show a strong reflectivity between two and three microns that is also absent from the planet spectrum.

ASTROPHYSICS

Pulsar magnetism not nuclear

Astronomers who have been studying pulsars generally agree that they are neutron stars, bodies that consist mainly of tightly packed neutrons, but with some protons and electrons also present. The pulsars appear to have very strong magnetic fields, and one of the major questions in pulsar theory is the identity of the mechanism that generates the fields.

One suggestion recently put forward is that the neutrons and protons generate the field by lining up the small magnetic fields that each of them possesses. They line up, says the hypothesis, because at neutron-star densities, the strong nuclear forces between them are repulsive. Lining up the magnetic fields tends to lessen the repulsion and increase the stability of the neutron star.

Drs. J. M. Pearson and Gérard Saunier of the Université de Montréal have done a theoretical study of this nuclear magnetism hypothesis, and they conclude in PHYSICAL REVIEW LETTERS for Feb. 16 that it cannot happen.

At the density of ordinary nuclei, the strong nuclear force is an attraction between neutrons and protons. At some point as the density is increased the force becomes a repulsion, and, say the Canadian physicists, the possibility of lining up the neutron and proton magnetic fields depends on how this transition occurs. According to their calculation it occurs in a way that precludes lining up the fields, and they conclude that pulsar magnetism must have some other source.

PARTICLE PHYSICS

More against McCusker's quarks

In September 1969 Dr. Brain McCusker of the University of Sydney reported that he had found tracks of quarks, the hypothetical ultra-elementary particles out of which all the known particles are supposed to be built. He saw them in cloud chamber records of cosmic-ray showers (SN: 9/13, p. 198). Other physicists were extremely dubious, and some have specific objections.

One of the reasons for believing that the particles Dr. McCusker saw were quarks was the amount of ionization along the tracks. Quarks are supposed to have either one-third or two-thirds the electric charge other particles have. A two-thirds charged particle should cause four-ninths the ionization of an ordinary particle, and this is what Dr. McCusker says he saw.

In the Feb. 9 PHYSICAL REVIEW LETTERS Drs. D. C. Rahm and R. I. Louttit of Brookhaven National Laboratory object that Dr. McCusker did not take into account the fact that ionization caused by a particle increases as the particle's energy increases. Cosmic rays come at quite high energies, and this, they say, makes it difficult "to establish the existence of two-third charged particles by ionization alone."