physical sciences

ASTROPHYSICS

Pulsar scintillations

Observations of a pulsar from the ends of a line 5,000 kilometers long rule out the possibility that fluctuations in pulsar brightness are caused by the earth's ionosphere or by plasma in interplanetary space.

So say Drs. E. K. Conklin and H. T. Howard of Stanford University and H. D. Craft Jr., and J. M. Comella of the Cornell-Sydney University Astronomy Center in the Sept. 21 NATURE.

Pulsar signals are subject to several kinds of scintillations or fluctuations of brightness, and astrophysicists are eager to know whether the scintillations result from some change in the source itself or whether they are caused by the signal interacting with some plasma between the source and the earth.

Simultaneous observations from widely separated points should show up any scintillations due to plasma near the earth, since signals arriving at different points follow different paths and the arrival times of peaks and valleys in the brightness should differ.

But observations at Stanford, and Arecibo in Puerto Rico, showed no difference. There remains, say the authors, the possibility of scintillations by interstellar plasma: The paths through that to two points on the earth are not sufficiently separate to make a difference.

PLANETARY ASTRONOMY

The temperature of Venus

Calculations of the temperature of the planet Venus from observations at different wavelengths range from 250 degrees K., when infrared data are used, to nearly 600 degrees when decimeter-wave radio is used.

Two theories have been brought forth to account for the variation. One is that the planet has a hot surface at about 600 degrees K. surrounded by a cool atmosphere opaque to wavelengths of less than a millimeter; therefore the shortwave signals come from the top of the atmosphere. The other is that it has a cool surface and is surrounded by a hot ionosphere which is responsible for the longer wavelength signal.

Recent observations at 21.3 centimeters wavelength, says Dr. N. J. B. A. Branson of Cambridge University in THE OBSERVATORY for August, support the hot-surface model, giving 570± 30 degrees K. with signal characteristics that rule out an ionosphere as the source. Therefore this signal most likely comes from the surface.

Further deductions from the signal characteristics indicate a porous surface with electrical properties similar to dry sand several meters deep.

ASTRONOMY

German journal widens field

Worldwide coverage in the fields of astronomy and astrophysics will be offered by ASTRONOMISCHE JAHRESBERICHTE, the editors have announced.

The journal will also increase the accessibility of its reports by initiating publication in English beginning in January 1969.

THEORETICAL PHYSICS

General relativity and satellites

The navigation systems of artificial satellites can be used in attempts to verify one of the predictions of general relativity theory—that a gravitational field affects the frequency of electromagnetic radiation emitted within it.

Drs. E. M. Gaposchkin and James P. Wright point out in Smithsonian Astrophysical Observatory SPECIAL REPORT 283 that the velocities of certain satellites determined by Doppler radar equipment should be corrected for general relativistic effects to make them correspond to the orbits of the satellites. Making such a correction implies an experimental verification of the relativistic effect.

Doppler radar makes use of the fact that electromagnetic radiation emitted or reflected by a moving body differs in frequency from radiation by the same body at rest. By observing the difference one can calculate the speed of the body in the line of sight.

In general relativistic theories an additional change occurs if the gravitational field strength at the emitter differs from that at the receiver. Thus, a signal emitted by a satellite and received at the earth should show the gravitational shift. One emitted from earth, reflected by the satellite and received again on earth should not.

Calculations show, say the two authors, that the relativistic effect is real, but at present they cannot choose between theories—Einstein's and others—that predict differing amounts of gravitational shift (SN: 6/1, p. 532).

MAGNETISM

Gravity and magnetic energy losses

The motion of a pendulum in a magnetic field seems to be subject to serious energy losses, due to an imbalance between gravitational and magnetic forces on the atoms of the material, reports Dr. Titus Pankey Jr. of Charlottesville, Va., in PHYSICAL REVIEW LETTERS for Sept. 16.

He draws this conclusion from observations of the motions of pendulums made of ferromagnetic material, which oscillate first in the vertical plane and then are turned so they oscillate in the horizontal plane.

Damping of the motion is expected to arise from friction with the air and from the resistance of the suspension wire against being twisted.

The orientation of the motion should not affect these forces. But in the experiment, the horizontal motion shows about 100 times the damping of the vertical.

Dr. Pankey's mathematical analysis of the situation leads him to attribute this effect to an imbalance between the gravitational and magnetic forces on the atoms of the material: The gravitational forces attract mainly the nuclei, which contain most of the mass, but the magnetic forces attract mainly the outermost electrons.

The result of the difference in the points of application of the forces is an unbalanced twist on the atoms—more pronounced in the horizontal geometry than the vertical.