physical sciences

PLANETARY ASTRONOMY

The radius of Venus

Data from the probes Mariner 5 and Venera 4 were combined to infer a radius of 6,079 kilometers for Venus. This raised a controversy because repeated radar measurements gave figures within one kilometer of 6,053.

In spite of the evidence now amassed for the smaller diameter, controversy continues, write Drs. Martin A. Slade and Irwin I. Shapiro of the Massachusetts Institute of Technology in the JOURNAL OF GEOPHYSICAL RESEARCH for June 10. Many observers are unable to reconcile the smaller radius with the observed brightness of the radio emanations from the planet.

In an attempt to settle the controversy Drs. Slade and Shapiro calculated what the surface atmospheric conditions ought to be, working from atmospheric effects on the radar and radio waves from the planet. In this they assumed an atmosphere composed according to data returned by probes that entered it.

The result gives a surface temperature of 750 plus or minus 50 degrees Kelvin and a pressure equal to 110 plus or minus 30 times the earth's atmosphere. These figures agree with an extrapolation of Mariner 5 temperature and pressure data to the surface at a radius of 6,052 kilometers; therefore Drs. Slade and Shapiro say the experimentally determined radar and radio spectra are compatible with the smaller radius.

FLUID PHYSICS

Liquid crystal lenses

In some liquids the molecules arrange themselves in an orderly pattern not characteristic of ordinary liquids but resembling the structures of solid crystals. Such structures are called liquid crystals (SN: 9/28/68, p. 321).

Dr. P. Andrew Penz of the Ford Motor Company in Dearborn, Mich., reports in PHYSICAL REVIEW LETTERS for June 22 that applying electric fields to certain liquid crystals can cause them to form lenses. The crystals in question are of the substance called *p*-azoxyanisole and belong to the class called nematic or needle-shaped. Application of a voltage above a certain threshold strength, Dr. Penz finds, makes the liquid crystals form vortices. Because of the way the liquid refracts light, the vortices constitute a lattice of cylindrical lenses. The focal length of the lenses varies with the voltage.

Behavior of this sort is predicted in the current theory of these liquids. Dr. Penz believes it could have important applications in optical displays.

SOLID STATE

Laser-produced sound

Laser light can be used to produce sound waves in solid bodies; the light reacts with structural characteristics of the solid in a variety of ways to produce vibrations.

Dr. D. C. Auth of the University of Washington at Seattle describes, in APPLIED PHYSICS LETTERS for June 15, a new method for using laser light to produce sound at microwave frequencies. The new method differs from the previous one for this frequency range by using two light pulses of identical rather than of different frequencies and by producing much higher power in the solid.

Two identical light pulses of about 10^{-11} seconds duration are sent into an absorbing solid at an angle to each other. At the points in the solid where the waves reinforce each other, they cause intense heating; the heat causes large pressure differences.

As the light waves beat against each other in the solid, the pressure at any point rises and falls periodically, generating two acoustical waves running in opposite directions. The frequency of the sound can be varied by changing the angle between the light beams as they hit the solid.

PARTICLES

Electron-antineutrino collisions

The so-called weak subnuclear force or weak interaction governs the beta decay of certain radioactive nuclei as well as the decay of a number of particles. It appears to be a force that is qualitatively different from the so-called strong interaction, which binds nuclei together; a separate theory, the so-called vector-axial vector or V-A theory, has been developed to describe it.

Experimental tests of the V-A theory are difficult because they must use particles that are subject to the weak interaction but not to the strong, and there are not many such particles.

Drs. Frederick Reines and Henry S. Gurr of the University of California at Irvine report in the June 22 PHYSICAL REVIEW LETTERS on an experiment in which they tried to determine whether collisions between antineutrinos and electrons occur according to the predictions of V-A theory. These two particles are important because they are the stable end products of weak-interaction decays, and they are experimentally feasible because neither is subject to the strong interaction.

The experiment determined a probability (cross section) for occurrence of the collision that is four times that predicted by theory. The experimenters consider the result not incompatible with the theory. In the future they hope to improve the experiment and refine the measuring technique so as to get nearer the theoretical value.

ASTRONOMY

Australian telescopes

An observatory staffed jointly by Australian and American astronomers will be built near Hobart, the capital of the Australian state of Tasmania. It will have four telescopes, a 50-inch, a 40-inch, a 26-inch and a 16-inch. The 50-inch and the 26-inch are being built under a joint program of the Fund for Astrophysical Research and the University of Tasmania. The other two will be obtained through the Australian Research Grants Committee. Funds for the building come from the Australian Universities Commission.

The observatory will be operated in conjunction with a radio observatory at Hobart Airport. The radio observatory will have two instruments made of wires strung on poles, a mile-long instrument for long waves and a 500-foot by 500-foot one for short waves.