physical sciences

Dry ice on Mars

The polar caps are probably the most prominently visible features of the surface of Mars. For decades astronomers have believed that they have to be either solid carbon dioxide or water ice. Because there is a large amount of carbon dioxide in the Martian atmosphere and on the basis of thermodynamic arguments many astronomers have been willing to believe the caps are carbon dioxide, but proof from spectral analysis of their reflected light has been hard to come by.

The Mariner 7 spaceprobe identified two lines that belong to the carbon dioxide spectrum, but one of these could also belong to methane, the other to ammonia. In the Feb. 1 ASTROPHYSICAL JOURNAL LETTERS Harold P. Larson and Uwe Fink of the University of Arizona report ground-based infrared observations of the south cap that reveal 11 lines of the carbon dioxide spectrum in the wavelength range 1.1 to 2.5 microns.

Laboratory studies of mixtures of water and carbon dioxide frosts have shown that even a small concentration of water in a predominantly carbon dioxide frost would obscure the carbon dioxide spectral details. Larson and Fink therefore believe that "carbon dioxide frost is a major, if not the dominant constituent of the Martian [south] polar cap.

Saturn at long wavelengths

To gain a total picture of the radio emission from a planet astronomers must build up a collection of observations at various wavelengths. Many points in the spectrum of Saturn at short wavelengths (under 21 centimeters) have been charted.

In a forthcoming issue of ICARUS (Vol. 15, p. 459) M. J. Yerbury, J. J. Condon and D. L. Jauncey of the Cornell-Sydney University Astronomy Center report observations at 49.5 centimeters (606 megahertz) made with the radio telescope at Arecibo, Puerto Rico. They calculate an over-all brightness temperature (the apparent temperature of whatever on the planet is emitting this wavelength) of 390 ± 65 degrees K. They also mention a revision of a previous measurement at 73.5 centimeters by W. B. McAdam to a brightness temperature of 704 ± 273 degrees K. With these two measurements, it appears that the radio spectrum of Saturn is practically constant at about 140 degrees K. from one millimeter to 3.5 centimeters. From 9 centimeters on the temperature rises with wavelength.

Collapsing stars and cosmic rays

How the cosmic rays obtain their great energies is one of the important mysteries of astrophysics, and many are the hypotheses that have been put forward. In the Feb. 7 PHYSICAL REVIEW LETTERS M. Grewing of the University of Bonn and H. Heintzmann of the University of Cologne suggest that collapsing magnetized stars may have something to do with it.

According to theories of stellar evolution, stars occassionally collapse to form neutron stars or black holes. As they do so they give up a lot of energy, and if they are magnetized, much of the energy is in the form of electromagnetic waves. Grewing and Heintzmann have made calculations to show that these waves could accelerate electrically charged particles by a process known as constant-crossed-field acceleration.

earth sciences

Monitoring Seattle's geologic foundation

In the past 25 years, two destructive earthquakes, one of magnitude 7.1, the other magnitude 6.5, have struck the Seattle-Tacoma area. The San Fernando earthquake of a year ago demonstrated the damage that can result from quakes in metropolitan areas.

To aid in developing seismic risk maps and better building codes, the National Oceanic and Atmospheric Administration is installing a network of about 90 instruments in the Puget Sound area to study the region's response to earthquakes. The study is the first for a major metropolitan area in which regional geology and soil distribution are taken into account. The geologic environment has a profound influence on the effects of earthquakes and on the resulting damage. The study is the forerunner of similar programs in other U.S. cities of high seismic risk.

Finding potential tornadoes

Radar observations have been used for some time to identify and locate storms, and certain radar echoes have been found to be associated with tornadoes, though the technique is not reliable for prediction. Scientists at the National Oceanic and Atmospheric Administration's National Severe Storms Laboratory in Norman, Okla., have developed a Doppler radar system that they believe can diagnose tornadic circulation inside a storm before a funnel actually forms. Conventional radar can record only the intensity pattern of precipitation in a storm; Doppler radar can measure the velocity at which rain particles are moving toward or away from the radar antenna (SN: 6/27/70, p. 621). From this information, observers can deduce circular motions.

Using the Doppler radar, Rodger A. Brown, Kenneth C. Crawford, William C. Bumgarner and Dale Sirmans were able to detect a counterclockwise circulation in a squall near Norman. Some 40 minutes later, a funnel cloud formed beneath the point where they had detected the circulation, they report in the most recent BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY. They believe the technique would be enhanced if several Doppler setups were used to probe the same storm.

A not-so-plain plain

Most of the Pacific floor has been found to be extremely complex, with thousands of undersea mountains, ranges, canyons and trenches. One of the notable exceptions has been the Tufts Abyssal Plain off the west coasts of Canada and the United States, a region as large as the central United States and generally believed to be a featureless plain.

A five-month survey of the area by U.S., Canadian and Japanese scientists as part of the International Decade of Ocean Exploration has found that the Tufts Plain, though indeed flat, is much more complex than previously thought. The researchers found, for example, that a network of undersea channels which they describe as more complicated than the Missouri-Mississippi river system cuts the plain. One channel was estimated to be 600 feet deep and 6 miles wide.

They also found that two mountainous areas are being uplifted and that two large and well-known seamounts—Cobb and Bear—may eventually rise above the surface of the ocean to become islands.

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