physical sciences

MOLECULAR ASTRONOMY

Sizes of water clouds

Very long baseline interferometry, a radio astronomical technique that combines signals received at widely separated telescopes to achieve very fine resolution (SN: 6/10/67, p. 544), has been used to measure the sizes of several interstellar clouds of water vapor. The observation used telescopes at the National Radio Astronomy Observatory in Green Bank, W. Va., the Naval Research Laboratory in Maryland Point, Md., and the Massachusetts Institute of Technology Lincoln Laboratory in Tyngsboro, Mass.

Astronomers involved were Drs. B. F. Burke, D. C. Papa, G. D. Papadopulous and P. R. Schwartz of the MIT Research Laboratory of Electronics, S. H. Knowles and W. T. Sullivan of NRL and M. L. Meeks and J. M. Moran of Lincoln Laboratory.

In the radio constellation W49 the group measured five separate water vapor sources. All were found to be smaller than 40 times the distance from the earth to the sun. In the constellation Orion are two sources no more than one and one half times the earth-sun distance across. Single sources were measured in Cassiopeia, 24 astronomical units across, and Canis Major, two astronomical units.

PARTICLES

Magnetic monopoles not found again

A magnetic monopole is a hypothetical particle that would have only a single magnetic charge, either a north or south pole alone. All known magnetic bodies have at least one north and one south pole, but theory predicts that monopoles should exist.

The latest search for them involved Drs. Robert L. Fleischer, Howard R. Hart, Israel S. Jacobs, P. Buford Price, Winfred M. Schwarz and Richard T. Woods of General Electric Co. in Schenectady, N.Y. Reasoning that if monopoles came to the earth as cosmic rays, they might survive in ocean-bottom sediments, the group examined old mineral samples for both monopoles and any of their tracks.

They report in the March 1 JOURNAL of APPLIED PHYSICS that no monopoles were found.

MOLECULAR ASTRONOMY

Maser action

Clouds in several parts of the galaxy emit radio waves generated by a transition between two different states of rotation of water-vapor molecules. These emissions, at 1.35 centimeters wavelength, have been studied over the past year by Drs. W. T. Sullivan III of the University of Maryland and S. H. Knowles of the Naval Research Laboratory, using the 85-foot radio telescope at Maryland Point, Md.

Among their conclusions is that the clouds they studied are acting as giant interstellar masers. The water vapor in the clouds, Dr. Sullivan told the meeting of the International Union of Radio Science in Washington, D.C., last week, absorbs infrared light emitted by stars. This raises the water molecules to an energy level they cannot maintain. They must reradiate the energy, and one of the steps in this reradiation is the radio line at 1.35 centimeters.

RADAR ASTRONOMY

Surface of Mercury

Radar observations of the surface of the planet Mercury have been undertaken both at the Arecibo Observatory in Puerto Rico by Drs. R. F. Jurgens, D. B. Campbell, T. W. Thompson and R. B. Dyce, and at the Jet Propulsion Laboratory's Goldstone Tracking Station in California by Dr. R. M. Goldstein. Results were reported at the International Union of Radio Science meeting.

The Arecibo group reports finding at least one rough spot on the surface of the planet. Dr. Goldstein reports several more. He says the rough spots are similar to those he has previously studied on Venus but are larger in relation to the size of the planet and with less contrast to surrounding areas. He says the rough spots tend to cluster in the planet's middle latitudes.

The Arecibo group concludes that the surface of Mercury is rougher than that of Venus on the average, but smoother than that of the moon.

MOLECULAR ASTRONOMY

Carbon monoxide

Carbon monoxide has been discovered in interstellar gas clouds in five locations in the galaxy.

The carbon monoxide revealed itself by characteristic radio waves at a frequency of 115 billion cycles per second (gigahertz) received at the 36-foot radio telescope of the National Radio Astronomy Observatory at Kitt Peak, Ariz. Drs. Keith Jefferts, Arno Penzias and Robert Wilson of Bell Telephone Laboratories did the observation.

The gas was found in the Orion nebula, in the galactic center and in the objects called Sagittarius B2, W2 and W51.

SOLID STATE

Superconductivity under pressure

Cooling certain metals to temperatures near absolute zero turns them into superconductors, substances without electrical resistance, in which currents flow without power loss.

In recent years it has become apparent that in some cases pressure as well as cooling has something to do with inducing superconductivity. Metals are found that are not superconducting under normal pressure but become superconducting under both pressure and cooling.

Two new superconductors under pressure are reported in the April 13 PHYSICAL REVIEW LETTERS by Dr. Jörg Wittig of the University of California at San Diego. They are cesium, in which superconductivity appears at 1.5 degrees K. after a pressure 125,000 times that of the atmosphere has induced a change in its crystalline structure, and yttrium, which becomes superconducting at about the same temperature and pressures above 110,000 atmospheres, without any change in crystal structure.