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FOR RELEASE IN A.M.
NEWSPAPERS OF
THURSDAY, NOVEMBER 14, 1963

(Editors: Principal investigators in the experiment described in this release will be available to answer questions starting at 2:45 p.m. Wednesday, Nov. 13, in Rehearsal Room A, Kresge Auditorium, at the Massachusetts Institute of Technology.)

Hydrogen combined with oxygen--in the form of what are called hydroxyl, or OH, radicals--has been detected and measured in interstellar space for the first time.

The observations, considered a milestone in radio astronomy, were performed by a team from the M.I.T. Research Laboratory of Electronics and the M.I.T. Lincoln Laboratory, with key support from the U.S. Air Force, using techniques that mingle radio astronomy with modern digital computer science.

Detection and measurement of hydroxyl provides the first experimental evidence to support the theoretical prediction that OH radicals exist in interstellar space and ends a search that has been carried on by radio astronomers for several years. Also, it is the first time that elements in combined form have been detected and measured by radio means in interstellar space. Atomic hydrogen, which is by far the most abundant form of matter in interstellar space, was first detected in 1951 with the discovery of the "hydrogen line"--the wavelength at which hydrogen can be identified by radio astronomers.

The M.I.T. team, in a letter to the British science journal, Nature, and scheduled for publication Nov. 30, reported the radio frequencies at which the OH radicals were detected were in close agreement with earlier predictions drawn from theoretical calculations and laboratory experiments. They reported their measurements showed OH radicals to be present in interstellar space in a ratio of about one OH radical to every ten million hydrogen atoms.

An OH radical contains an atom of oxygen and an atom of hydrogen--one less hydrogen atom than is present in a water molecule. Astronomers have predicted the presence of OH radicals in interstellar space in minute quantities, just as there are undoubtedly occasional atoms of all kinds of elements and even some kinds of radicals present in space, and there is also the probability that once in a long while an OH radical comes near to and combines with a hydrogen atom to form an interstellar water molecule--H_2O.

Participating in OH radical detection were Professor Alan H. Barrett of RLE and Dr. Marion L. Meeks, Dr. Sander Weinreb and Mr. John C. Henry, all of Lincoln Laboratory. Their observations were carried out on ten different days between Oct. 15 and Oct. 29 using the 84-foot parabolic antenna of the Lincoln Laboratory Millstone Hill Observatory at Westford, Mass., the observatory's CG 24 digital computer, and a special correlation radiometer.

The Millstone Hill facilities were developed by Lincoln Laboratory under sponsorship of the Air Force as part of a long-term advanced radar research program. Dr. Weinreb, now on the Lincoln staff, developed the correlation radiometer while performing doctoral thesis research at RLE, an M.I.T. interdisciplinary laboratory supported by the three military services. Dr. Barrett's participation in the experimental program was supported by the National Aeronautics and Space Administration.

The team scanned the frequency spectrum of the relatively weak radio emissions from the radio source Cassiopeia A and measured slight absorptions of energy (corresponding to only two degrees in temperature readings) at two frequencies--1667.35 and 1665.40 megacycles per second (18 centimeters wavelength).

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These are frequencies at which OH radicals were shown to absorb radio energy in laboratory experiments carried out at Columbia University in 1959 by Dr. C. H. Townes, G. Ehrenstein and M. Stevenson. Dr. Townes, now M.I.T. Provost, and Dr. I. S. Shklovsky of the USSR had earlier and independently suggested the existence of OH radicals in interstellar space based on theoretical considerations.

Dr. Barrett, then at the Naval Research Laboratory in Washington, D. C., and an associate, Dr. Edward Lilley, now of the Harvard College Observatory, in 1956 were among the first to search for OH radicals, but were unsuccessful then because they lacked precise knowledge about hydroxyl absorption frequencies that Dr. Townes and associates were to supply later.

In the Millstone experiment, the special radiometer and the digital computer enabled the researchers to spot and plot the dips--indicating OH absorption--in Cassiopeia A's signal strength at the specified OH absorption frequencies which had previously been missed because of less sophisticated equipment and techniques.

By repeating the experiments over a period of several days--while the earth moved in its orbit around the sun--the researchers were able to observe a slight shift in OH absorption frequencies--on the order of a few thousands of cycles per second--showing that the OH doing the absorption was not in the earth's atmosphere and, hence, was somewhere in the intervening interstellar space.

Atomic hydrogen was the first substance to be detected and measured in interstellar space by radio astronomy techniques. In the early 1940's, the Dutch astronomer Dr. H. C. van de Hulst, had predicted that atomic hydrogen in interstellar space could be detected by radio astronomers. In 1951, Professors H. I. Ewen and E. M. Purcell at Harvard first detected this hydrogen line at a frequency of 1420 megacycles per second (21 centimeter wavelength).

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Hydrogen absorption characteristics since have been used to study and chart by radio techniques vast clouds of hydrogen present in interstellar space and invisible by techniques of optical astronomy.

Finding the OH lines and determining their characteristics is expected to have a similar impact on studies of the interstellar regions. The lines should help astronomers to chart the distribution and abundance of OH--and hence, oxygen--as well as hydrogen throughout the galaxy and to study the motions of these atoms and radicals, greatly extending knowledge of astrophysical interactions.

Other elements--calcium, titanium, sodium, potassium, and iron--and certain other radicals--cyanogen (CN) and hydrocarbon (CH)--have all been detected in minute amounts in interstellar space by optical astronomy techniques.

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Following is biographical information on the principal investigators in the detection and measurement of OH radicals in interstellar space:

Dr. Alan H. Barrett(of 3 Dane Rd., Lexington, Mass.), a native of Longmeadow, Mass., received his B.S. degree in electrical engineering from Purdue University in 1950, his M.S. degree in electrical engineering from Columbia University in 1953, and the Ph.D. in physics from Columbia in 1956. He was at the U.S. Naval Research Laboratory, Washington, D.C., from 1956 to 1957 and at the University of Michigan from 1957 to 1961 when he came to M.I.T. as associate professor of electrical engineering and a specialist in radio astronomy at the M.I.T. Research Laboratory of Electronics.

Dr. Marion L. Meeks (of 26 Oakland St., Lexington, Mass.) was born in Gainesville, Ga., and grew up in Atlanta, Ga. He received his B.S. degree in 1943 and his M.S. degree in 1948, both in physics from the Georgia Institute of Technology. He was awarded his Ph.D. degree in physics from Duke University in 1951. He was associate professor at Georgia Institute of Technology from 1951 to 1961 when he joined the Lincoln research staff. During the 1959-60 academic year, he was at the Harvard College Observatory.

Dr. Sander Weinreb (of 78 Carroll St., Watertown, Mass.), a native of Atlanta, Ga., received his B.S. degree in 1958 and Ph.D. degree in 1963, both in electrical engineering from M.I.T. He joined the research staff at M.I.T.'s Lincoln Laboratory in March, 1963.

Mr. John C. Henry (of Virginia Rd., Concord, Mass.) is a native of Providence, R.I. He received his B.S. degree in electrical engineering from the University of Rhode Island in 1956 and has been a member of the Lincoln research staff since then.

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