ASTRONOMY

Matter In Empty Space

Astronomical mystery is partly cleared by discovery of "impossible" substance in "empty" space. Identified as CH. One spectral line remains unexplained.

➤ A SUBSTANCE impossible on this earth, but lying in the vast stretches of so-called "empty" space between the stars, partly clears up an astronomical mystery of long standing. It accounts for three of four spectral lines that have puzzled astronomers. The fourth is still unexplained.

The substance is hydrogen carbide or carbon hydride, whichever you prefer to call it. But astronomers simply call it CH, for the molecule is composed of one atom of carbon and one of hydrogen.

The final step in the proof was accomplished by two Canadian physicists who looked not at the sky but through the eyepiece of a spectrometer in the laboratory. The physicists are Dr. A. E. Douglas of the National Research Laboratories in Ottawa and Prof. G. Herzberg, physicist at the University of Saskatchewan.

The spectrometer is the instrument that spreads light out in a rainbow and tells what things are made of here and in the skies, provided the spectrum "lines" are identified with similar lines given by a known substance. Each line corresponds to a particular wavelength of light. A good instrument will measure this to a 25-billionth of an inch.

Astronomers examining the stars with this instrument have noted four sharp lines which did not correspond to those of any known substance. On theoretical grounds and as a result of mathematical calculations they attributed them to CH, existing in the space between the stars.

Much of this work was done by Dr. Theodore Dunham, Jr. and Dr. Walter S. Adams of the Mount Wilson Observatory in California, and Dr. Andrew McKellar of the Dominion Astrophysical Observatory, B. C.

But the astronomers could not be sure of their conclusion, because since CH does not exist on the earth, its "lines" had never been seen.

All this has now been remedied, for Dr. Douglas and Dr. Herzberg have produced three of the lines in the laboratory and positively identified them as belonging to CH. The fourth line which did not appear, they gave good reasons for believing does not belong to CH. Hence, the fourth line still remains a mystery.

The reason why CH (and also CH_2 and CH_3) are "impossible" compounds on this earth is that the normal quota of the carbon atom is four atoms of hydrogen. If it has a less number, it is unsatisfied or "unsaturated," and immediately sets out to fill its quota. It may accept other atoms than hydrogen or it may join with other unsaturated hydrocarbons to form the large groups or the long chains that compose the molecules of petroleum, rubber and other organic compounds.

The carbon atom has no difficulty here in filling its quota, with plenty of materials close at hand, 500 billion billion molecules to a cubic inch of air. But out there in "empty space" it is believed that there is about one atom or molecule to a cubic yard. If the carbon atom were magnified to the size of a pea, and the cubic yard were similarly magnified, there would not be another atom of any sort within a million miles. The carbon atom would be lucky to get even one hydrogen atom to share its loneliness, and however much it might yearn for more, it would be a long time before it got any. CH can therefore very well exist for prolonged periods in "empty" space.

The manner in which the Canadian scientists produced CH lines in the laboratory was by admitting a small amount of benzene to an atmosphere of inert helium gas and passing an electric discharge. Apparently the discharge broke up the hydrocarbon molecules of the benzene and CH existed momentarily while the carbon atoms were filling their quotas.

How short this time is may be gathered from the fact that CH_3, which would be the most stable of the three compounds, had previously been produced in the laboratory, but half of it disappears in 1/1,000 to 1/10,000 second.

The lines obtained by the Canadian scientists were very faint. Exposures of one to ten hours were required to photograph them.

Twice before have mysterious spectral lines puzzled astronomers. They were then attributed to new elements not yet discovered on the earth, but in both cases they turned out to be very common earthly substances, but in a peculiar state. There were the mysterious green lines seen in the spectra of nebulae, which were attributed to an unknown element, which was called "nebulium." But in 1927, Dr. I. S. Bowen of the California Institute of Technology showed that it was simply oxygen and nitrogen emitting "forbidden" lines, possible only when the gases are extremely attenuated.

Again, a conspicuous green line and others in the spectrum of the sun's corona were attributed to an unearthly element and named "coronium." But in 1941, the Swedish astronomer, Dr. Bengt Edlen, showed that these lines were probably due to atoms of iron and calcium stripped of most of their electrons by some powerful agency that had not been duplicated on the earth. Finally, 1942, the Indian scientist M. N. Saha proposed that the highly damaged atoms were produced by "fission", the famous process by which physicists are seeking atomic power.

In any case scientists believe that all possible elements have now been discovered. No new ones will be found in the sky.

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MEDICINE

War Medicine Practiced In Sandbagged Hospital

See Front Cover

➤ SOMEWHERE in Hawaii stands the unit of a mobile base hospital established by the Navy's Bureau of Medicine and Surgery, shown on the front cover of this week's SCIENCE NEWS LETTER. It is fully staffed by doctors, nurses and Medical Corps men and equipped with modern operating room. The mobile base hospital is located as near the fighting front as is possible, or if necessary, in dangerous bombing zones.

The sandbag "thatching" is mute evidence of the new methods of warfare used by our enemies. Evidently, hospitals can no longer be conspicuously undefended and marked with the huge red cross that used to provide immunity in former wars.

The cover picture is an official U. S. Navy photograph.

Science News Letter, September 19, 1942