



in the constellation of Orion which were completely different in character from the stellar lines and showed motion—which also can be determined from the nature of the spectrum—quite distinct from that of the star.

They soon were recognized as due to atoms of ionized calcium, that is, atoms minus one electron. Several years later the existence of normal sodium was established from the presence of two well-known lines in the orange region of the spectrum. It so happens that both these lines are easily produced and are exceedingly prominent in laboratory sources and in the spectrum of the sun.

Needed Powerful Equipment

The next step awaited the development of more powerful instrumental equipment. Then, about four years ago, astronomers of the Mount Wilson Observatory identified four lines as due to ionized atoms of the rare element titanium and one each of neutral calcium and neutral potassium.

At the same time they found various other faint lines which were hard to match. Nine of them were in the blue and violet portion of the spectrum. The lines were sharp and narrow in appearance. Seven others, mostly in the red region, were diffuse and broad. The origin of these latter is still unsolved. The blue and violet lines did not correspond to any known to come from any of the elements. The suggestion that they might be due to molecules came from several independent sources. A detailed investigation was made at the Dominion Astrophysical Observatory in Canada. It was concentrated on the relatively few lines, out of the thousands in the bands of the more common compounds in the laboratory, which might be expected to occur under the conditions of interstellar space. Among these were a few lines of the simplest carbon combinations—carbon-nitrogen and carbon-hydrogen. Such a molecule consists of one atom of each element.

Six of the blue and violet lines in inter-

stellar clouds matched lines of these compounds. Three others, two fairly prominent in the clouds, remained unidentified. Within the past few months investigations at the University of Saskatchewan have shown that these also belong to carbon-hydrogen in an ionized condition, or with one electron missing from one of its atoms.

The latest discovery of the Mount Wilson astronomers is that of iron in interstellar space. This is an abundant element throughout the universe. The light given out by iron atoms, however, is distributed among the great number of spectral lines and none is of such predominant intensity as that of some of the lines of calcium and sodium. Any interstellar iron lines could be expected to be extremely faint.

The search was concentrated on two ultraviolet lines in the iron spectrum which arise from the undisturbed state of the atom. After repeated attempts these have been successfully photographed.

At Interesting Stage

The study of these cosmic clouds now is at a most interesting stage. Astronomers know, in part, what they are made of, although doubtless other elements and other simple molecules will be found. They know something of their size, density and distribution. Their composition is far from uniform. Different elements appear to predominate in the gaseous composition of different clouds. This is a field which calls for detailed investigation.

The clouds are not stationary. They are moving with all the complex movements of the galaxy and they have independent drifts of their own. The direction and rate of their movements also can be deduced from study of their spectra. There is a shift towards the red end of the spectrum when an object is moving away from an observer, and the extent of this shift depends upon the speed. Conversely, there is a shift towards the blue when an object is ap-

SPECTROGRAPH FROM SPACE

It is this sort of record that has revealed to scientists the make-up of the great clouds in heavenly space. On the broad white line, the dark bands near each end indicate the presence of ionized titanium. The close pair in the center are due to neutral sodium.

proaching. The motions of the clouds with respect to one another now are being studied. From these investigations may come new light on complex dynamics of the titanic star system.

Interstellar space provides a laboratory for the study of matter under conditions which can be found nowhere else. What is the state of matter under such conditions? Study of the clouds between the stars holds out a hope for some of the answers.

With techniques known at present there would appear to be no hope of penetrating beyond some of the densest of these clouds. They are like great black curtains drawn down in the face of man's curiosity regarding some of the remotest and most significant regions of the vast system of which he forms a part, such as the center of the galaxy. The more he can learn about the nature of these curtains, the greater the prospect will be of seeing something of the mysteries which they hide.

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RESOURCES

Midwest Now Grows Coriander Seed

CORIANDEr seed that add pungent flavor to candy, beverages, soup and other products are now coming from midwestern farms, instead of such far-off lands as Morocco, France, and the Balkans.

Present midwestern planting consists of 150 acres, with production of about 40,000 pounds of seed. Coriander was formerly summed up by the Department of Agriculture: "No commercial production in the United States."

Science News Letter, November 1, 1941