

SCIENCE NEWS

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SOME PAPERS READ BEFORE THE CINCINNATI MEETING OF THE AMERICAN ASTRONOMICAL SOCIETY

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ORION'S TRAPEZIUM STARS MAY SHOW RELATIVITY SHIFT

EVERY amateur astronomer who possesses even the smallest of telescopes has turned it to the great nebula in the sword of Orion and discovered the four brilliant, blue stars buried in the nebulosity which form the Trapezium.

Dr. Otto Struve, director of Yerkes and McDonald Observatories, reported to the Cincinnati meeting of the American Astronomical Society the results on his spectrographic study of these four stars. Dr. Struve and Dr. John Titus, a Yerkes astronomer, jointly observed the Trapezium stars in March and April of this year, but they found the spectra of the stars difficult to measure because the bright, emission lines of the nebula itself were superimposed over the stellar spectrum in each case. They were, however, able to determine that the lines of the Trapezium stars were displaced toward the red end of their spectra more than the emission lines from the Orion nebula.

The usual interpretation of the shift of lines in a spectrum, other factors being accounted for, is that the star is approaching us if the lines are shifted toward the violet and receding from us if the shift is to the red. The average velocity of recession for the nebula is about 10 miles a second, but the Trapezium stars show red shifts indicating that they are going away from us nearly twice this fast. They have always been thought to have been closely associated with the nebula, so it is surprising to find that they are apparently moving as a group through it, and will some day be out of its vicinity.

An alternative explanation was suggested by Dr. Struve, however, for he called attention to the probable large masses of these stars. As they are blue stars with very hot surfaces, they can be ordinary stars and still shine as brightly as red giant stars many times their size. This combination of large mass and small size is just what is required to produce an observable Einstein or relativity shift in the spectrum of a star. The large mass produces a strong gravitational field, particularly strong in a small star because its surface is close to its center. Light escaping from such a field loses some of its energy on the way out and appears redder than normal.

It was in the white dwarf stars, such as the companion of Sirius, which has a density 50,000 times that of water, that the relativity shift predicted by Einstein was first actually observed, helping to prove his theory. Dr. Struve's extension of observations to more ordinary stars

such as those in the Trapezium represents a triumph of observational astronomy. This is, however, only proposed by Dr. Struve as a substitute to considering that the four stars are moving through the nebula, and that it is not known now which alternative is the true one.

CEPHEID VARIABLES

PULSATING stars known as Cepheid variables are among the best timekeepers in the world. Particularly regular in their pulsations are the short-period or cluster-type Cepheids, which go through a complete expansion and contraction in about half a day. Their changes in size are observed by us as variations in the positions of the lines in their spectra, which are also accompanied by fluctuations in the brightnesses of these stars.

So regular are such stars, for instance, the one known as AR Herculis, a tenth-magnitude star in the constellation of Hercules, that Everett C. Yowell, of Columbia University, has been able to determine its period as 11 hours, 16 minutes and 51 seconds. This information he derived from examining Harvard plates of the region of the sky containing this star and extending from 1899 to 1925. But on plates from the latter time to 1941, the period of the star is found to be 11 hours, 16 minutes, and 49.6 seconds, or 1.4 seconds shorter than formerly.

Together with a change in the rate of its primary fluctuations, this celestial timepiece has revised its "secondary" period as well, as Mr. Yowell finds that this, too, has changed, increasing by about three seconds in 1925.

What happens inside such a star to make it so suddenly start beating a new rhythm is not known, but it must be explained by some real physical change. Meanwhile, astronomers are searching for other stars whose periods have changed unexpectedly.

DIMINISHING RETURNS OF ASTRONOMY

THE law of diminishing returns, so well known by its applications to agriculture and economics, applies to astronomy too, according to Dr. Joel Stebbins, director of Washburn Observatory of the University of Wisconsin.

In his address as retiring president, Dr. Stebbins said that many methods of astronomical observation and research had reached the limit of their practicability, and were fast being replaced by simpler and more effective approaches to the job of finding out what makes stars "tick."

As telescopes are made larger and larger, there is much less than a proportionate increase in power, and even this is offset by such factors as the enormous size required for mountings and observatories to house the instruments. With the famous 40-inch Yerkes refractor, the practical limit of size for telescopes employing a lens to focus the light has been reached, and that telescope is already nearly 50 years old. The 200-inch telescope, now nearly completed on Mount Palomar in California, will undoubtedly be the largest telescope of any kind for a long time

to come, and it may be that no larger such instrument will ever be built.

Disregarding the mechanical problems, the larger a telescope, the greater its light-gathering power, the greater its ability to resolve close points of light, such as double stars, and the greater its magnification (if its focal length increases with its size). But more than offsetting resolution and magnification are the vagaries of the atmosphere, through which all light from sun, moon, and stars must pass. High magnification is used with large instruments only rarely, when "seeing" conditions are perfect. Light-gathering power is the prime purpose in building such an instrument as the 200-inch giant. However, the compensating feature is the comparatively small part of the sky which this telescope will be able to photograph at one time. In reflectors, particularly, the usable field of view is small, which is one of the reasons the newer type of telescope known as the Schmidt camera is so important. It has great light-gathering power combined with a large usable field.

"In astronomy as elsewhere," said Dr. Stebbins, "it is important to look for new methods before a given field is worked out. The modern photoelectric cell and amplifier are a million times as sensitive as similar equipment of a generation ago. But here again the precision with which the light of a star can be measured is limited by the twinkling of the star caused by atmospheric disturbances. An accuracy of one tenth of one per cent. is about the best obtainable at the present time."

With new equipment on the 100-inch telescope at the Mount Wilson Observatory, Dr. Stebbins and his colleagues have secured observations of stars in six colors, compared with previous work in only one or two colors. These studies have been applied to stars, nebulae, and especially to the dark nebulae between the stars. Dr. Stebbins pointed out that a large part of his own work in the past ten years has already become out of date because of improvements by these same investigators in the last year or two.

DISTINCTION BETWEEN PLANET AND STAR

DR. K. AA. STRAND, of Sproul Observatory, Swarthmore College, considers the invisible third component of the triple star 61 Cygni to be of the nature of a planet rather than a star. He believes further that a continuation of the accurate photographic observation of double stars will increase the number of such systems and will reveal stellar masses of such small magnitude that the boundary between planet and star, which has previously seemed clear enough, will disappear.

Two of five such unseen companions which he has discovered have masses about half that of the sun, and one has a mass about one tenth of the sun's; but all three are undoubtedly stars, only they are too faint to be seen.

Of the remainder, one is still somewhat doubtful because sufficient observational material is lacking, but the mass of the fifth one, in the 61 Cygni system, is known accurately as one sixtieth that of the sun, or sixteen times

Jupiter's mass. Jupiter is the largest planet in the solar system, its mass equalling that of all the other planets combined.

Dr. Peter van de Kamp, director of the Sproul Observatory, reported on similar results with single stars. In this case, departures from straight-line motion across the sky are discovered by very carefully taken photographs; the departures are caused by invisible companions. Dr. van de Kamp presented a new such discovery—that of a companion to Luyten's star, the companion taking fifteen years to revolve about the visible star.

STAR SPEEDS

LIKE the molecules of air in a room, heavyweight stars move slowly and lightweight stars move rapidly. Researches by Dr. A. N. Vyssotsky, of the Leander McCormick Observatory of the University of Virginia, on the motions and distributions of dwarf stars appear to confirm this hypothesis.

Before a symposium on dwarf stars and planet-like companions, Dr. Vyssotsky explained how his selection of the comparatively small or "dwarf" stars was made from the relative intensities of different portions of their spectra, and independently of their apparent motions across the sky. Most other methods of making the selection have been based on such motions, and any attempt to determine the average real motion of such dwarfs as a class was handicapped by their having been selected on the basis of motion in the first place.

It had previously appeared that dwarf stars (mostly of the size of the sun and smaller) had more than their share of energy—that they moved through space too rapidly for their masses if the energy of the galaxy were equally divided. Dr. Vyssotsky has slowed the dwarfs down a bit, just enough to make it possible to apply the law of the equipartition of energy, important in physics and thermodynamics, to the majority of the stars in the galaxy.

VELOCITY OF SMALL K STARS

A STAR moving away from the sun at a speed of 155 miles per second (250 kilometers per second) has been found by Dr. Frank K. Edmondson, of Kirkwood Observatory, University of Indiana. This is a speed of over a half million miles per hour. This star is one of the smaller stars of the universe, of the spectral type called K, which makes it smaller and redder than the sun. In his reporting, Dr. Edmondson stated that his discovery was made in the course of an investigation of the motions of certain selected stars fainter than the tenth magnitude. His work indicates that the small K stars have a wider range in velocity than expected. To account for this, we must suppose that there are a large number of such so-called dwarfs, compared to the giant stars. Previously, the percentage of dwarfs had been supposed to be about 20 per cent. or 30 per cent., but the new results indicate that it may be as high as 80 per cent. Only about half a dozen stars are known with velocities exceeding 155 miles per second (250 kilometers per second).