ASTRONOMY

Variable Stars Seen As Stage In Evolution of "Red Giants"

Important Measuring Rods of Universe, the Cepheids, May Themselves Turn Into Stars of an Ordinary Kind

CEPHEID variable stars, which change periodically in light in a characteristic manner, getting bright rapidly and dimming more gradually, may represent a stage in the evolution of another kind of star, called the "red giants," and the Cepheids may themselves turn into a star of an ordinary kind.

This theory was suggested by Dr. Edward Teller, of George Washington University, at a meeting of the American Physical Society devoted to sources of stellar energy. Cepheid stars are important to astronomers as measuring rods of the universe. The brighter they become, the more slowly they change. Thus, when the period of variation of one is found, the astronomer can judge its candlepower. Seeing how bright it looks, he can tell how far away it is.

The red giants are really very diffuse. in the summer constellation of the scorpion, and Betelgeuse, which shines in the winter sky in the figure of Orion. They are many millions of miles in diameter, ten to 100 times as big as the blue stars. The red giants are really very diffuse. If we had a piece of one on earth, we should call it a pretty good vacuum.

Though the reactions in the nuclei of atoms which yield the stellar energy are on an entirely different scale from ordinary chemical reactions, Dr. Teller said that they have the common characteristic that both are speeded with high density and temperature. Thus, more easily reacting nuclei must be present in the red giants, since these stars, in spite of their lower densities and their presumably lower internal temperatures, produce as much energy as ordinary stars.

In ordinary stars, he said, the atoms responsible for energy production are mainly those of carbon and nitrogen. However, he thinks the responsible atoms in the red giants are lighter ones like those of beryllium, lithium, boron and deuterium (or heavy hydrogen). He said that Moses Greenfield, in a paper to be published shortly, discusses the consequences of these reactions in greater detail. Dr. Teller's studies indicate that the main production of energy from these atoms would sometimes not be at the center of such a star, but in a shell a little way out from the center.

If this shell gets sufficiently far away from the center, the star would probably not be stable, but it would start oscillating, as astronomers believe the Cepheids to be doing. So, he concludes, the red giants may become Cepheids in one stage of stellar evolution.

However, after some millions of years, the supply of the light elements would become exhausted, he suggests, and then the Cepheid might become an ordinary, non-variable star.

No H in White Dwarfs

INSIDE the white dwarf stars, like the curious companion of Sirius, the dog star, which is so dense that a cubic inch of its material, though still gaseous, would weigh a ton, no hydrogen is present. So reported Dr. R. E. Marshak, of the University of Rochester. The temperature deep in such stars is about 10,000,000 degrees, he estimates.

It is believed that these dwarf stars are made up mostly of "degenerate" gas. That is, instead of being made of atoms, they consist of swarms of single electrons, which are building blocks of atoms. A great many more electrons can be packed in a given space than atoms, which are many times larger.

In the process by which the stars are normally kept fueled, nuclei of atoms hit each other and hydrogen is transmuted into helium, with carbon, then nitrogen, then carbon over again, and so on, as intermediate stages.

At the high densities of the white dwarfs, if this process were operating, collisions of the nuclei would be much more frequent, and consequently these stars should give off many times as much heat as the sun, yet their output really is considerably less. Dr. Marshak, in explanation, says that there is practically no hydrogen in these stars, except, in a few cases, in an outer shell a few hundred miles thick.

Without hydrogen, he attributes the

production of energy of the white dwarfs to contraction. That is, the energy released as the outer parts fall to the center is converted into heat. Proposed nearly a century ago, a similar theory was once given in explanation of stellar energy in general, but it was shown that it would not provide energy for the times over which the stars seem to have been in existence. Dr. Marshak says that it would suffice to keep the white dwarfs going for 100,000,000 years at least, and after that they will probably become dark objects.

Dr. H. A. Bethe, of Cornell University, whose theory of the hydrogen-helium transmutation as the source of most stellar energy is now generally accepted, addressed the meeting as well. Dr. George Gamow, of George Washington University, who presided, spoke on his theory that stellar explosions are due to particles called neutrinos, which have no mass.

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ARCHAEOLOGY

Takes "1,000-to-1 Chance" Of Finding Oldest Virginians

Smithsonian Scientist Will Explore Remnant of Site Left From Excavation for Four-Lane Skyline Drive

ON a "1,000-to-1 chance" of striking important revelations of the first—literally first—families of Virginia, Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution, is preparing to make archaeological excavations beside Virginia's famous Skyline Drive near Bedford.

Since discovery there recently of ancient Folsom Man's typical stone dart points, the Virginia Mountain site has been a question-mark spot for popular and scientific interest. Will it, or will it not, reveal as much information about Ice Age Southerners as Dr. Roberts has learned about Ice Age Westerners from digging in the Lindenmeier site, where Folsom Man camped in Colorado, 20,000 years ago?

Possibility that Indian souvenir-hunters of the twelfth or thirteenth century A. D. may unwittingly have given modern science a false steer on Folsom Man's presence at the site is cautiously seen by Dr. Roberts.

"The two Folsom dart points were found in debris of a prehistoric camping ground," he explains. "This may mean that Folsom hunters who reached Virginia camped or worked there 10,000 years, or more, in the past. While Folsom Man's presence in Virginia has been previously detected from such points, they have been found on the surface of the ground. None of his Virginia campgrounds have been examined, which might reveal the sort of food he ate, his other kinds of stone and bone tools, and other evidence of his life in Eastern America. Most important of all would be discovery of skeletal remains, for Folsom Man's appearance is unknown.

"Prehistoric America, however, had its souvenir hunters and antique collectors, and it is possible that the campground was occupied by Virginia Indians of comparatively recent times — recent compared to Folsom Man's era—and one of them may have brought home and kept an old Folsom point.

"In the Southwest, we find traces of Indian collectors frequently. An Indian pot may be unearthed full of odd objects that the owner previously collected and treasured."

To find out which of these solutions is correct, Dr. Roberts will have only a remnant of the original site to explore. Highway excavations for the four-lane Skyline Drive cut through the old site, removing 95% of it. It was during the digging that workmen first observed Indian objects. Dr. David I. Bushnell, Jr., Smithsonian Institution archaeologist called to the site, recognized its significance for American prehistory.

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● RADIO

John L. Collyer, president of the B. F. Goodrich Company, and Dr. Howard E. Fritz, manager of the company's synthetic division, will discuss synthetic rubber and rubber-like materials as a means of conserving supplies of imported natural rubber vitally needed for defense as guest scientists on "Adventures in Science," with Watson Davis, director of Science Service, over the coast to coast network of the Columbia Broadcasting System, Thursday, May 15, 3:45 p.m. EDST, 2:45 EST, 1:45 CST, 12:45 MST, 11:45 a.m. PST. Listen in on your local station. Listen in each Thursday.

METALLURGY

Patented Process May Aid Production of Magnesium

THREE new methods for the more rapid purification of magnesium, essential defense metal which, because of its lightness, is used in airplane construction, were revealed in four patents just granted by the U. S. Patent Office. Thomas H. McConica, III, of Midland, Mich., is the principal inventor, though Charles E. Nelson and Thomas Griswold are named in two as co-patentees.

In purifying magnesium from its ores, it is obtained as a vapor, mixed with carbon monoxide, the vapor being condensed to form the solid metal. When first produced, the vapors are hot, and, unless quickly cooled, there is a chemical reaction to form a magnesium compound