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EDWIN E. SLOSSON, Director
WATSON DAVIS, Managing Editor

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GASES HEAVIER THAN LEAD

By Dr. Edwin E. Slosson.

Professor A. S. Eddington of Cambridge can spring more sensations in a half hour talk than any other sober-minded scientist I ever heard. He broke the record at the Toronto meeting of the British Association for the Advancement of Science when he expounded his new theory of the constitution and evolution of the stars. An old-fashioned physicist, if any such were in the lecture room, must have been shocked to hear him talk so calmly of gases more than fifty times heavier than platinum, of temperatures over twenty million degress centigrade, of light waves that are lengthened by gravitation, of chemical elements losing their identity, of stars puffed cut by the internal pressure of X-rays, of dwarf stars that are giants at heart, of gases made up of more electrons and nuclei, of matter converted into energy, and of stars that are dissolving into light.

If these were more speculations, such as some astronomers indulge in, Camille Flammarion for instance, nobody need mind, but Professor Eddington insists and persists in proving his points. He began by working out the mathematical theory of star formation on the assumption that its substance behaves like a perfect gas. Then on plotting the observational data of stars of all sorts these were found to fit closely to his theoretical curve, even our own sun which has a density one and a third times greater than water. From this he concludes that stars in general obey the laws of perfect gases, regardless of their density, and that their luminosity depends mainly upon their mass, the density making comparatively little difference.

Some stars seem to have a density heavier than platinum. For instance, the faint companion of Sirius has a mass eight-tenths as much as the sun, yet its size, as judged by its light, must be so small that its density should be fifty thousand times that of water. Whether its mass is really so great may be determined by observing the Einstein shift in its spectrum and this is now being teste at the Mt. Wilson Observatory.

The new theory conflicts with the theory advanced by Prof. H. N. Russell of Princeton and now commonly held, that stars start out in life as red giants of extreme tenuity, that heat develops as they contract, and that they get hotter as they lose heat, until they become white hot and then gradually cool down to red heat again. Prof. Russell, in spite of the fact that a hard blow has been dealt at the theory which had given him an international reputation, was the first to congratulate Prof. Eddington on his achievement. "I take off my hat to him," he said, "for this is the second time he has deduced from mathematical principles what ought to have been obvious but was not perceived before."

A possible agreement between the rival theories may be brought about by invoking Einstein's idea that matter may be converted into energy and radiated off into space. Professor Eddington says: "It is possible that a star may gradually diminsih in mass during its evolution. This would happen if it obtains its energy of radiation by annihilating electrons and protons, thus burning itself away."

Acccrding to Prcfessor Eddington's theory, stars continue to get hotter as they shrink until the central temperature is over ten million degrees Centigrade. At this heat the atom of the heavier elements would be stripped of its outer electrons and the atom of the lighter elements, like carbon and oxygen, would be reduced to the bare nucleus. The atoms in the stars would then have only about one hundred thousandth of the bulk of ordinary atoms, and such a gas could be compressed a hundred thousand times further than the gases we deal with on earth before the atoms begin to get crowded. In such a state all the stellar gases must have about the same molecular weight, 2.1, whatever may be the elements that compose them.

When I was young astronomers used to try to scare us by telling us that the sun and stars were slowly cooling down and at length the universe would be left all dark and cold. That did not worry us enough, so now they have changed their tactics and prophesy a time when the elements ahsll melt with a fervent heat and the sun shall be no more. This sounds more alarming, for it would be worse for the human race to be roasted alive than frozen to death, and the idea that the solid ground may ultimately be dissipated into radiant energy and go rambling around a four-dimensional continuum forever gives one a new kind of shiver.

DISCOVER UNIVERSE'S LARGEST STARS 10,000 TIMES BRIGHTER THAN SUN

The most conspicuous stars in the Magellanic Clouds are greater in size and in brightness than any of the giant stars heretofore known to astronomers, according to investigations just announced by Dr. Harlow Shapley, director of the Harvard College Observatory. Many of these stars are believed to excel the far-famed red giants Betelgeux and Antares, and in diameter probably approach the diameter of the orbit of Jupiter, some 966,600,000 miles.

Extensive photometric work has led finally to the determination of the distanc of the Small Magellanic Cloud. Similar investigations are under way for the Large Cloud. These stellar systems, which are visible only in southern latitudes, derived their name from descriptions given four hundred years ago by the navigator Magellan. They look like large patches of the Milky Way, but are quite detached from the Galaxy.

Through a prolonged study of the variable stars discovered in the Magellanic Cloud by Miss Leavitt at the Harvard Observatory twenty years ago, a method has been developed for the determination of the distances of star clouds and clusters. Only this year, however, has it been possible to give a decisive value for the magnitudes of the stars in the Small Magellanic Cloud, and consequently to measure the distance and dimensions of the system. It is now found that the diameter of this Cloud is sixty-five hundred light years. The distance from the earth is thirty-two kiloparsecs, which is equivalent to a little over a hundred thousand light years. A star of the luminosity of our sun would at this distance be of the twenty-third magnitude.