

Cosmic Helium Abundant

► A NEW THEORY has been proposed to explain the amount of helium in the universe, as well as how aging stars spew much of their matter into interstellar space.

Observations indicate there is about twice as much helium in the universe as can be accounted for according to present scientific theory on the formation of new stars from the debris of old ones.

Dr. Howard D. Greyber of the Imperial College of Science and Technology in London suggested a new "powerful mixing process" in stellar interiors to explain the high proportion of helium.

The same process would also account for the large amounts of material thrown into space by stars in the late stages of evolution. Such losses of mass have been observed on astronomical photographs and on ultraviolet photographs taken by rockets when in the most rarefied part of the earth's atmosphere.

The mechanism proposed by Dr. Greyber is effective only during a specific period of time in the lifetime of a star, about 100,000 years on the average. Many stars are stoked by burning hydrogen, more and more of which turns into helium as the star grows older.

The so-called red giant stars are believed to have an outer, very tenuous but very large halo of hydrogen and an inner core of high density helium. Between these is a very narrow shell in which hydrogen is being burned.

When the hydrogen in this shell stops burning, the stellar halo cools rapidly, causing the star to adjust by gravitational attraction. The enormous light hydrogen halo falls under gravity toward the heavy helium gas core, slamming into the dense boundary between the two.

Previous theoretical investigations have shown that when this happens, spikes of the heavier helium penetrate deep into the hydrogen, while bubbles of the light hydrogen are depressed into the helium.

Dr. Greyber's report in *Nature* 210:510, 1966, is based on these previous investigations and his new attack on the problem of how aging stars eject their matter into space.

He concludes that "shortly after the shell has stopped burning, large spikes of helium will surge out from the edge of the core, pushing hydrogen

before it." If small amounts of heavy elements or a strong magnetic field exists in the outer part of the dense core, they would also be brought to the star's surface.

The helium or heavy elements, as well as any magnetic field, would surge into space at speeds of 10,000 to 100,000 centimeters per second, or from 10 to 100 times the pull of gravity at earth's sea level.

Dr. Greyber notes that many generations of massive stars hurling matter heavier than hydrogen spaceward could bring the predicted amount of helium in the universe into agreement with the observed abundance, previously in disagreement by a factor of two.

• *Science News*, 89:425 May 28, 1966

TECHNOLOGY

Undersea Platform Holds Instruments

► FOR THE FIRST time, variations in the earth's magnetism were successfully recorded by instruments suspended 100 feet below the Pacific Ocean, about 100 miles west of Los Angeles.

Secured on a unique underwater stable platform, the magnetometers performed automatically for a month, reported researchers of ESSA (the Environmental Science Services Administration).

The platform was anchored to the ocean floor 4,300 feet below by three 1,500-pound anchors, held by quarter-inch steel cables. To prevent the cables from sagging of their own weight and to insure the stability of the platform, glass balls encased in nylon nets were attached to each cable.

The magnetometers were the first to be successfully located in the sea for measuring changes in the earth's magnetism, said Dr. Leroy Alldredge, acting director of ESSA's Institute for Earth Sciences. Previous tests in the deep ocean had proved unsuccessful.

Other instruments could be fastened to the undersea platform for continuous recording of such things as sea tides, ocean currents, temperatures, and the passages of tsunamis or huge sea waves caused usually by earthquakes.

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Nature Note

Trumpeter Swan

► THIS LONG-NECKED creature, all white except for a jet black bill and feet, is the rarest swan in the world, as well as being the largest waterfowl.

The trumpeter swan, *Olor buccinator*, is one of two swans native only to North America—the whistling swan is the other. The trumpeter has a hornlike call that resounds like a mellow French horn across the northern sky.

These birds used to be common throughout North America when the white man first explored the continent. They were reported in the summer months nesting and rearing their young downy chicks in northern Alaska and Canada, east to Hudson Bay and as far south as Mississippi. They once spent the winter along the Atlantic seaboard, in the Mississippi Valley and along the Gulf Coast.

But the white man coveted the birds and shot them from the sky and their plumage was converted into hats, dress ornaments, powder puffs and down coverings.

By 1900, the trumpeter swan had been hunted so much that the species was nearly extinct. Conservationists finally realized the plight, and in 1918, the Migratory Bird Treaty Act outlawed the hunting of these birds. It was almost too late. In 1933, only 66 of these great white swans were reported in the United States.

Today they live and nest in protected security among the marshes and sedge meadows of the mountainous Red Rock Lakes National Wildlife Refuge in southwest Montana. The population has slowly been brought back to nearly 1,000 individuals.

The 20- to 30-pound birds feed on aquatic plants. Choosing a mate they keep all their lives, the trumpeter swans build a five-foot-wide nest on top of muskrat houses along a stream. Here the female swan incubates her three to seven dull white eggs for about five weeks.

She then coaxes her emerging babies, grayish with yellowish feet and pink bills, to swim.

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