ASTRONOMY

"Black Holes" in Space

The heavy densely packed dying stars that speckle space may help determine how matter behaves when enclosed in its own gravitational field—By Ann Ewing

➤ SPACE may be peppered with "black holes."

This was suggested at the American Association for the Advancement of Science meeting in Cleveland by astronomers and physicists who are experts on what are called degenerate stars.

Degenerate stars are not Hollywood types with low morals. They are dying stars, or white dwarfs, and make up about 10% of all stars in the sky.

The faint light they emit comes from the little heat left in their last stages of life. It is not known how a star quietly declines to become a white dwarf.

Degenerate stars are made of densely packed electrons and nuclei, or cores of atoms. They are so dense that a thimbleful of their matter weighs a ton.

Some such stars are predicted in theory to have a density of one million tons per thimbleful. When this happens, the star is essentially made of neutrons and strange particles.

Because a degenerate star is so dense, its gravitational field is very strong. According to Einstein's general theory of relativity, as mass is added to a degenerate star a sudden collapse will take place and the intense gravitational field of the star will close in on itself.

Such a star then forms a "black hole" in the universe.

Modern tools, such as telescopes on an orbiting space platform, may be used to detect such black holes and to help determine how matter behaves when it is enclosed by its own gravitational field.

The light from the most famous white dwarf star, Sirius B, a companion to Sirius—which is the brightest star in the heavens visible from earth—has been captured using the 200-inch telescope atop Mt. Palomar. This was done as part of a program to study at least 20 white dwarfs.

Preliminary analysis of the light from Sirius B indicates that it has an effective temperature of 16,800 degrees Kelvin, or 30,000 degrees Fahrenheit. Its radius can be calculated from the temperature, and is only nine-thousandths that of the sun.

The star must therefore consist mainly of helium or heavier elements.

The speakers at the symposium were Drs. A. G. W. Cameron of the National Aeronautics and Space Administration's Goddard Institute for Space Studies, New York; Charles Misner of the University of Maryland; Volker Weidemann, Physikalisch-Technische Bundesanstalt, Braunschweig, Germany, and J. B. Oke of California Institute of Technology. The symposium was arranged by Dr. Hong-yee Chiu of the Goddard Institute for Space Studies.

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SPACE

Spot Positrons From Space

➤ A BALLOON carrying its own magnetic field has been used positively to spot positrons from space for the first time, three scientists reported in New York.

Positrons are anti-particles of electrons, and have been created artificially and detected in unstable elements.

Although positrons have been known for years to be a part of the cosmic radiation continually bombarding earth from space, they have not been directly detected in cosmic rays before because there was no way to sort them out from electrons.

However, scientists from the University of Chicago and Argonne National Laboratory solved this problem by sending aloft, at a point where the earth's magnetic field is weakest, a balloon with an atomic particle detector having its own magnetic field.

Photographs of the atomic debris in the particle detector showed whether the electrons were negatively or positively charged by how they curved in the magnetic field. The ratio of three to one between the numbers of electrons and positrons indicates how these particles are born in space.

The high-altitude experiment, conducted from Fort Churchill, Canada, was reported in Physical Review Letters, 12:3, 1964, by Drs. Peter Meyer and Roger H. Hildebrand of the University of Chicago and Dr. James A. DeShong of Argonne National Laboratory.

They believe there are two independent processes at work to form cosmic ray electrons:

1. The explosion of stars, or supernovas, during which electrons are shot into space.
2. The collision of protons with other protons in space, as can be made to happen on earth in giant atom smashers. From such particle collisions are formed neutral pi mesons that finally decay into equal numbers of electrons and positrons.

Funds for the experiment were provided by the National Aeronautics and Space Administration and the Atomic Energy Commission.

The Office of Naval Research and the Royal Canadian Air Force provided support facilities.

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METEOROLOGY

Weather Vans Promise Better Local Forecasts

➤ ON-THE-SPOT weather data from satellites soon will be available directly to local forecasters through the use of special vans being outfitted by the Government.

The vans receive signals through a spiral-shaped roof-top antenna and provide cloud cover pictures of the local area as "seen" by the weather satellite.

Pictures will be used by weather forecasters in the van for vast, large-scale cloud observations not now possible.

The vans, which can be transported by air or truck, are being tested at Hanscom Field, Mass., by the Air Force, the U.S. Weather Bureau and the National Aeronautics and Space Administration.

Inside weather satellites, such as Tiros and Nimbus, television transmission devices automatically take and transmit a cloud picture every three minutes during daylight. Each picture received by the vans will cover an area of about 640,000 square miles, from which the operator will be able to make his weather analysis.

In an emergency the mobile stations can be flown to any spot in the world and placed in operation in as little as two hours after landing. They can be used in military operations and for locating and tracking severe storms such as hurricanes and typhoons.

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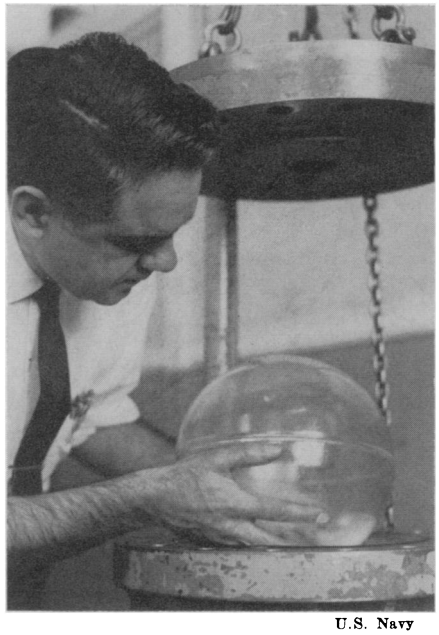

U.S. Navy

GLASS SUBMARINES? — Hollow spheres of common glass, because of their high compressive strength and relatively low weight, may be used for hulls of deep-diving submarines of the future. Robert M. Charles, engineer at the U.S. Navy's David Taylor Model Basin, Washington, D. C., is shown placing a hollow glass sphere into a pressure tank for hydrostatic testing.