ASTRONOMY

# Solve Technetium Mystery

**The mystery of how the element technetium can remain in the interior of a star has been solved, it is believed, with the discovery of a long-lived isotope.**

➤ THE MYSTERY of technetium, the "ghost" element found only in certain kinds of stars or when artificially produced by atomic bombardment, is believed solved.

One form of technetium, element 43, has a half-life of 2,600,000 years, Dr. A. G. W. Cameron of the Atomic Energy of Canada, Ltd., Chalk River, Ontario, reported. Previously, he told the American Astronomical Society meeting in Rochester, N. Y., the longest-lived form of technetium known had a half-life of 210,000 years.

Dr. Cameron said the relatively short-lived technetium 99 is actually destroyed quickly in a star's interior. The isotope 97 is the one with the 2,600,000-year lifetime.

The baffling mystery had been the existence of technetium in stars when all its known forms had such "short" lifetimes, astronomically speaking. Dr. Cameron's discovery of technetium 97's long lifetime was a by-product of a recent theory concerning how stars are stoked.

Many red giant stars contain unusually large amounts of heavy elements, often including technetium. These heavy elements are built up from light ones in the interior of the star through a series of neutron captures. Providing a sufficiently potent neutron source to allow the manufacture of heavy elements has been a problem.

Dr. Cameron reported that this difficulty may now have been solved as a result of investigating the nuclear reactions that accompany the burning up of carbon by thermonuclear reactions in hot stars.

When a star is formed out of the gas and dust in interstellar space, it consists mostly of the light gas, hydrogen. The center of the star heats up and the hydrogen is converted into helium by thermonuclear reactions when the temperature is about 20,000,000 degrees absolute.

After the hydrogen has been exhausted at the star's center, the temperature rises again. At about 140,000,000 degrees, the helium is changed into carbon by a new set of thermonuclear reactions. When the helium becomes exhausted, the temperature rises again. At about 600,000,000 degrees, the carbon is destroyed, forming neon, sodium, magnesium and a variety of other relatively light elements.

Among the products of these carbon thermonuclear reactions, Dr. Cameron reported, are both protons, or hydrogen nuclei, and alpha particles, or helium nuclei. The carbon being consumed has an atomic weight of 12. It captures the protons to form a nitrogen atom of weight 13, which soon breaks down to form a rarer carbon atom of weight 13. This heavy carbon atom then captures the alpha particles to produce oxygen atoms and also neutrons.

If the star contained some iron and other similar medium-heavy atoms when it was formed, then these iron atoms will capture the neutrons. The iron atoms can thus be built up into very heavy atoms, such as observed to be so unusually overabundant in certain red giant stars. Technetium could be built in this way.

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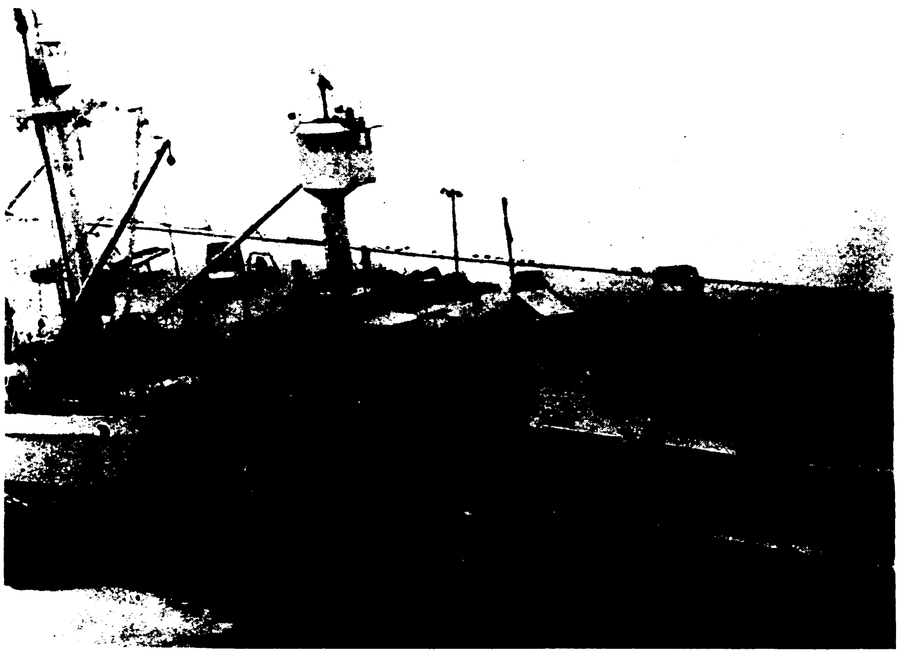

*ICE-FREE WATER—Compressed air lines laid at predetermined depths alongside a pier in Thule, less than 800 miles from the North Pole on Greenland's west coast, carry dense saline solutions to the surface and prevent ice formation. Bubbles can be seen surfacing in the open water area at the right. The port was kept open 40 days past its normal closing time last fall by using this system, pioneered in Scandinavia by Atlas Copco of New York.*

ASTRONOMY

## Find "Hot Spots" on Sun's Face in Ultraviolet Light

**See Front Cover**

➤ THE SUN'S face shows "hot spots" when photographed in far ultraviolet light.

The first pictures of the entire solar surface taken in this energetic, invisible light were made by scientists at the Naval Research Laboratory from an Aerobee-Hi rocket shot to a height of 123 miles from White Sands Missile Range, N. M. They showed the sun was twice as big in far ultraviolet light as it appears in the visible part of its radiation.

Eventually such rocket astronomy methods are predicted to allow routine photography of the sun's weather and how it affects the earth's high atmosphere. When viewed in the extreme ultraviolet, or Lyman alpha, light of hydrogen, the sun is "strikingly" stormy, NRL scientist Dr. Richard H. Tousey said.

The sun's Lyman alpha radiation has profound effects on that part of the earth's atmosphere lying between 40 and 55 miles above the surface called the D layer of the ionosphere, which is used for shortwave communications.

The highly detailed photographs were made with a special camera using mirrors ruled with 15,000 lines to an inch instead of lenses. A similar camera with a TV-like scanner at its focal point might be placed in an astronomical satellite within two years to telemeter its picture of the sun.

The photograph on the cover of this week's SCIENCE NEWS LETTER shows the face of the sun when viewed from the NRL rocket on March 13, 1959.

The rocket shoot was originally scheduled as part of the U. S. International Geophysical Year program, but the launching was postponed until March 13 because the areas where the instrument payload might land were too damp.

A complicated servo system built by University of Colorado scientists was used to keep the instrument pointed at the sun during its flight. The ultraviolet solar photographs can be taken only from rockets and satellites because the radiation is absorbed high in the earth's atmosphere.

James DeWitt Purcell and Donald M. Packer worked with Dr. Tousey in the first successful effort to photograph the sun in Lyman alpha radiation.

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