Physical Sciences Notes

RADIOACTIVE TRACING

Output Measured in Live Animals

Radioactive isotopes, such as carbon 14 and hydrogen 3, are often injected into test animals to see where they, and other materials they combine with, end up.

One problem with this test method is that some tracer isotopes give off such low amounts of radiation that they can't be measured without killing experimental animals, dissecting the organs and preparing elaborate samples.

A new technique, developed by three scientists at the New York University Medical Center, uses a secondary product of carbon 14 radiation to detect the presence of the isotope without elaborate dissection.

The primary radiation from carbon 14 consists of beta rays, or electrons. These electrons are slowed up as they pass through the body of the experimental animal, and in the process of slowing they give off electromagnetic radiation called bremsstrahlung, or "braking radiation."

It is the secondary bremsstrahlung that is measured by the new technique. Experimenters Jerry C. Rosen, Gerard R. Laurer and Merril Eisenbud reported in the July 7 SCIENCE that bremsstrahlung produced by carbon 14 was detected from depths of several centimeters in experimental rats.

ASTRONOMY

New Comet in Southern Hemisphere

The second new comet of the year—bright enough to be seen with the naked eye by those south of the southernmost tip of the United States—has been reported by Moonwatch observers in Townsville, Australia.

The new comet, named Mitchell-Jones-Gerber (1967f) after its first observers, has a tail seven degrees long. This is about 14 times as long as the full moon appears from earth, unusually long for a comet although not as spectacular as some comets in the past.

The comet was first discovered by Herbert E. Mitchell, headmaster of Queen's Beach State School near Bowen, Australia. Other sightings, both in Australia and Argentina, were reported to the Smithsonian Astrophysical Observatory in Cambridge, Mass., international clearing house for astronomical information.

POWER GENERATORS

European Isotope Thermocouples

Eight member countries of the European Nuclear Energy Agency are collaborating in a program to develop small electric generators powered by thermocouples which take their heat from radioactive decay of isotopes.

A thermocouple is a heat-sensitive pair of unlike metals, joined at one end and open at the other. When the joint is heated—in this case by radioactive heat—an electric voltage is generated across the open ends.

A similar system has been developed by Britain and is already operating as a navigation light, and the U.S. Atomic Energy Commission's SNAP program employs similar technology.

Member countries supporting the ENEA project are France, Germany, Sweden, Denmark, Spain, Portugal, Austria and Switzerland. Aim of the program is a source that would produce between a millionth and a thousandth of a watt of electricity.

Radioactive isotopes are waste products of nuclear power generators. There is a good deal of interest in finding uses for them, since otherwise their disposal is likely to become a big pollution problem as nuclear power becomes more widespread.

CRYSTALLOGRAPHY

Low Temperature Crystals Formed

To study the properties of materials, single crystals that are chemically pure and physically as free from defects as possible are needed.

The usual way of forming crystals involves melting the material first, and this high temperature can cause defects.

Scientists at the National Bureau of Standards have developed a way of forming crystals of calcium molybdate at temperatures well below its 1400 degree C. melting point. The crystals thus formed are more nearly perfect than those produced by regular methods.

The key to the method was forming a solution of calcium molybdate in lithium sulfate. In a proper proportion, this solution is a liquid at less than 960 degrees C.

The NBS experimenters, H. S. Parker and W. S. Brower Jr., form a three-layer sandwich composed of a tiny seed crystal of calcium molybdate, the solution, and a solid block of calcium molybdate. The block is heated to 960 degrees, and the seed crystal to 830 degrees, with the solution somewhere in between.

What happens: some molecules from both the block and the seed crystal dissolve into the solution; but because the solution at the block side is hotter, the dissolved molecules diffuse toward the cooler side, at the seed crystal. This results in a super-saturated solution around the crystal, and the molecules begin to deposit onto the seed. This process continues as long as the temperature difference is maintained, resulting in continuous growth of the crystal.

The technique could be extended to growing crystals of other materials, according to the experimenters. The research was reported in the current SOLID STATE COMMUNICATIONS.

ASTRONOMY

Far Infrared Gap Surveyed

Astronomers would like to know the composition of interstellar dust that they think goes to form new stars. They make their guesses by measuring the radiation coming from the dust, but the earth's atmosphere cuts out almost all radiation in the infrared range (SN: 4/22).

First observations of radiation in the infrared at 350 microns were reported in the July 14 SCIENCE by Drs. William F. Hoffmann and Nevile J. Woolf of the Goddard Institute for Space Studies. The observations, which were made with balloon-borne instruments at 100,000 feet, indicated that the amount of radiation from interstellar dust grains corresponds to a temperature of not more than 10 degrees above absolute zero, if the dust is opaque. From this information, combined with more data gathered in future experiments, they hope to determine the composition of the dust.