SCIENCE NEWS

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YOUNG AND OLD STARS

THE sun is young and the brilliant, dense white dwarf star Sirius B is old among the stellar bodies, it appears from a report made to the American Physical Society by Dr. R. E. Marshak and Professor Hans A. Bethe, of Cornell University.

Sirius B is the relatively tiny star whose diameter is only 20,000 miles. Yet it is as massive as the sun, whose diameter is about 1,000,000 miles. Sirius B is 20,000 times as dense as the sun.

The dense, dwarf star consists of a gaseous envelope whose density is only slightly larger than that of the sun and a very dense core. The boundary temperature (between the envelope and the core) of Sirius B has been calculated at 8,000,000 degrees Centigrade. Previous calculations suggested that this boundary temperature was as high as 60,000,000 degrees.

Dr. Marshak and Professor Bethe, in new calculations, find that there can be only a very small amount of hydrogen present in Sirius B. It is the gas hydrogen which is now believed to be the "fuel" which most stars burn to create their enormous outpourings of radiation.

At the high temperatures and densities of Sirius B the radiation would be enormous if the dwarf star contained as much hydrogen as the sun. Therefore it is concluded that Sirius B contains less than one thousandth of one per cent. of hydrogen.

In the case of Sirius B it seems that the star has reached a stage wherein the high temperature and observed brilliance is caused mainly by gravitational contraction of the star.

PARTICLES OF URANIUM ATOMS

THE explosion of uranium atoms, with the release of enormous amounts of atomic energy and the production of two "splitter" particles which are probably barium and krypton, occurs over a volume of space about an inch in radius, it is shown in experiments reported in *The Physical Review*.

Dr. Edwin McMillan, of the radiation laboratory of the University of California, describes studies which indicate that the splitter particles cast off by uranium in its new-found explosion and break-up have a "range" of 2.2 centimeters or nearly an inch.

The splitting of uranium by impact with neutrons (neutral atomic particles) is thought to be the most important discovery in physics since radium and radioactivity were found at the turn of the century.

In another report credited to nine investigators at Columbia University estimates were given of the effective cross section of the neutrons which produce such uranium splitting. This cross section, for slow or thermal neutrons, is given as 2×10^{-24} square centimeters or .000,000,000,000,000,000,000,002 square centimeters. These slow neutrons have been found to be especially efficient in splitting uranium. Fast neutrons, found alone to be able to split thorium, are even smaller by a factor of 20 times.

From the Department of Terrestrial Magnetism of the Carnegie Institution of Washington was the report of Drs. R. B. Roberts, R. C. Meyer and P. Wang that the uranium splitting not only gave off energy and two particles but also released a neutron. Potentially this neutron could strike a near-by uranium atom and perpetuate the release of atomic energy.

ATOMIC DISINTEGRATION

FOR the first time anywhere investigators at the University of Notre Dame have demonstrated that an electron —lightest of all atomic particles—can produce an atomic disintegration.

Professor George B. Collins, Dr. Bernard Waldman and William R. Polye, of the department of physics, have shot swift flying electrons from the atom smasher into atoms of the chemical element beryllium. Out of the impact each beryllium atom, of mass nine, was turned into two atoms of helium, each with mass four, and into a neutron of mass one. The energies of the electrons used as "bullets" in the research were 1,720,000 electron volts.

The experiments are highly important to science because they indicate another way in which neutrons can be created by atomic bombardment. Neutrons are the massive, neutral particles used so widely in the current splitting of uranium with the release of vast amounts of atomic energy.

Previously investigators have been unable to effect transmutation of the elements and atomic disintegration with electrons. Cores of hydrogen atoms, known as protons, deuterons and neutral particles, the neutrons, have been employed.

Professor Eugene Guth, of Notre Dame, made the mathematical calculations forecasting that high energy electrons might disintegrate beryllium in a way which these experiments have now confirmed.

The actual train of events in the bombardment, according to Professor Guth, is that beryllium of mass nine, when struck by the electron, forms beryllium of mass eight, plus a neutron, plus a low energy electron. The beryllium, mass eight, almost instantly breaks down into two helium atoms, each with atomic mass four.

THE X-RAY MACHINE IN THE TREATMENT OF CANCER

CHIEF weapon against cancer in the future, so far as treatment is concerned, will be a new 600,000-volt x-ray machine which, unlike the 1,000,000-volt machines, can be handled by the private physician and small hospital and which will replace radium in treatment of cancer except in a few types of cases.

This prediction is made on the basis of a statement by Dr. Francis Carter Wood, director of the Institute of Cancer Research at Columbia University, in his twenty-fifth annual report to the president of Columbia University.

Because of the expense and space requirements, a

million-volt x-ray machine is out of reach of the individual physician and the small hospital, to whom most cancer patients must turn for treatment. The question is, therefore, what is the lowest voltage that gives as good results in treating deep-seated cancer as a million-volt x-ray.

Experiments at the Crocker Institute have shown that x-ray at 200,000 volts is not as satisfactory as higher rates, but that it is altogether unnecessary to go above 700,000 volts and that even 600,000 volts is practically nearly as good as a million.

Dr. Wood believes that the electrical engineering of x-ray apparatus has reached such a point that it should be possible in a very short time to put on the market a machine giving off 600,000 volts which could be handled by a physician and that this, for a long time, will be all that is necessary for the treatment of cancer with this type of radiation. It will, with but few exceptions, replace radium in the treatment of cancer.

Radium, or perhaps some artificially radioactive substance, it was pointed out, will always be used for the treatment of tumors where it can be inserted into the growth itself, thus causing destruction without having any of the radiation pass through the skin.

THE MICROVIVARIUM AT THE WORLD'S FAIR

THE world in a water drop, magnified so that minute microbes look as big—and as lively—as jackrabbits, will be shown to visitors at the New York World's Fair in the microvivarium, of which Dr. George Roemmert, of New York, is the inventor. It will be housed in the Westinghouse building.

This instrument is a combination of microscope and projection lantern. Powerful beams of light, projected through trains of lenses, project the images of living one-celled plants and animals on screens so that the audience can see the intense dramas of their little lives plainly and on the largest scale. Dr. Roemmert will have twelve of these projectors in operation at once, so that the show will be large and varied. A microvivarium of an earlier model was one of the successes of the Chicago Century of Progress.

Among the manifold scenes of life in the usually invisible world is a display of the mating of the slipper animalcule, or paramecium. This is something that not even scientists had been able to demonstrate until recently. Usually the paramecium reproduces by simply dividing in two, each half then swimming off and rapidly growing to full size. But in this microscopic romance two individuals swim alongside of each other for a while, and then simply coalesce. It is literally a case of one plus one equals one.

Other tiny animals shown in the microvivarium are shaped like tiny bells, that stand bottom side up at the end of long, slender stalks. A fine muscle-like fiber runs down through each stalk, so that when the little animal feels danger near, or just wants to for any other reason, it pulls itself down like a flash by contracting the usually straight stalk into a tight spiral like a coiled spring. The microvivarium is also used to show the details of the inner lives of some of the smaller many-celled animals, particularly minute worms, insect larvae and microscopic relatives of crabs and crayfish. It shows, for example, the writhings of vinegar worms, the swallowing movements and heartbeats of a mosquito larva and the unborn young in the brood-pouch of the minute crustacean known as the water-flea.

THE METCALF BLIND LANDING SYSTEM FOR AIRPLANES

PERFECTION of a virtually fool-proof blind landing system for airplanes seems assured within the next year or two, following successful tests at East Boston Airport of major elements in a new radio-beam method developed by investigators at the Massachusetts Institute of Technology and by Irving R. Metcalf, of the Civil Aeronautics Authority.

Radio micro-waves only seventeen inches long, the shortest ever applied to aeronautical radio, provide a straight, static-free path down which an airplane can make a normal "straight" landing glide to land in the middle of the runway, no matter how thick the weather outside the cockpit. The plane is in proper position for a landing at all times during the glide.

There is only one instrument for the pilot to watch, and it may be used to simplify regular instrument flying as well. The apparatus, when finally assembled, will be extremely light. It is the first blind landing system whose principle—the straight glide path—meets the requirements of Army fliers.

Actual flying tests were conducted recently in a small plane owned by the Civil Aeronautics Authority which proved that a "spotlight" beam of extremely high frequency radio waves can be used effectively as part of a trail blazer for airplanes trapped in fog.

Three lighted dots in a cathode ray tube instrument in the pilot's dash board tell him whether he is on course or, if he is not, in what way his position is wrong. When the three lights are lined up horizontally, with the middle dot properly centered, the plane is on course.

The plane's gyroscopes, indicating bank and climb, control movements of the outer lights. The center light is controlled by four overlapping "spotlight" beams of radio micro-waves. When the plane follows the straight glide path—the area in which the four beams meet—the signals of the separate radio beams will be equalized, and the center light will remain on center. If the plane rises or falls, or moves to left or right of the path, the relative signal strength of one of the beams will increase, and the spot will be deflected in that direction.

The Metcalf-Massachusetts Institute of Technology system has other advantages as well as inherent simplicity. The signals are not reflected from the ground and hence are independent of ground conditions. Because the instrument follows the relative strengths of four signals sent out by the same transmitter, the absolute volume of the four signals makes no difference. This is not true of previous blind landing systems, which have required cumbersome, sensitive apparatus to overcome this difficulty.

Originally suggested by Mr. Metcalf, the system's development has been made possible by the cooperation of Professors Edward L. Bowles, W. L. Barrow, W. M. Hall and Charles S. Draper. Army, Stanford University and Sperry Gyroscope Company experts have also cooperated.

The basic idea was first used by Mr. Metcalf in guiding a landing by three visible lights on the ground. One light was at ground level, at the center of the runway. Two other lights were placed on either side of the runway, at an appropriate height from the ground. If the pilot lined up the three light in a row, he made a good landing. Pilots made scores of semi-blind landings with this system, observing the lights through a ground glass screen.

The straight glide path is superior to the curved path provided by earlier systems using radio waves reflected from the ground. In following a curved glide path, the pilot must often change his angle of descent. Moreover, the curve flattens out toward the ground. Just as the plane is closest to making an actual landing, therefore, it is moving forward much faster than at the top of the glide.

A RUSSIAN NON-MAGNETIC SHIP FOR RESEARCH TRIPS

THE Soviet Government is planning a non-magnetic ship for research on variations in the earth's magnetic field in the Arctic regions, according to *The United Services Review*, British military and naval journal.

Because of the sensitiveness to near-by iron masses of the instruments used in magnetic survey work, it is necessary to build research ships intended for this purpose out of wood, with bronze, aluminum and other non-magnetic metals substituted for iron wherever possible.

The new Soviet vessel is planned to be of 700 to 800 tons displacement, yacht rigged, with an auxiliary engine.

Plans under discussion also include carrying an airplane, on which the *Review* comments, "How the metal difficulty will be overcome has not been fully explained."

In the meantime, the new British non-magnetic ship, *Research*, is nearly ready for duty, and a search is being made for officers and seamen experienced in handling sailing ships. In this steam-and-motor-dominated age, sailors who can readily sail are not as numerous as they used to be.

ITEMS

WHEN really heavy rain falls in California, that's "unusual." But when enough rain falls to make a lake in Death Valley, that's news. And that's what has happened, U. S. National Park Service observers report from the famous desert valley. The Armagosa River, usually nothing but a dry wash, has overflowed its banks and spread out into a lake dozens of square miles in extent. Death Valley is not completely rainless, even in "usual" years. Its annual precipitation averages a trifle under an inch and a half. Even this little is enough to carpet the earth with flowers for a short time in the spring. This year, because of the heavy rains, the spring wildflower show is expected to be even finer than usual.

THE ear trouble which is the "most common subjective complaint of both airplane pilots and passengers" can be relieved or prevented by inhalations of helium and oxygen, Drs. W. R. Lovelace, II, C. W. Mayo and W. M. Boothby, of the Mayo Foundation, have found. They suggest inhalations of these two gases whenever possible during periods when marked changes in elevation of the plane are occurring, especially when descending for landings. This is especially important for persons who have difficulty in opening their eustachian tubes voluntarily as by swallowing or yawning.

INTERSTELLAR space is almost synonymous with the ultimate in emptiness but actually there is so much matter in space that the stars of the Milky Way would seem twice as bright as they do now if the "dust" were eliminated. "Since the effect of interstellar dust is to make objects look fainter than they otherwise would, the estimates of distance for faint stars have been too great," Dr. Joel Stebbins, director of the Washburn Observatory of the University of Wisconsin and research associate of the Carnegie Institution, said in an address recently. "The overall diameter of the galaxy, or system of stars of which our sun is a member, is probably about 100,000 light years instead of the 200,000 light years which was inferred without allowance for the absorption of light in space." A light year is an astronomical unit equal to the distance light would travel in a year at a speed of 186,000 miles a second. A light year amounts to 6,580,000,000,000 miles. Dr. Stebbins, with his colleague, Dr. A. E. Whitford, has for the past decade been studying the heavens by using photoelectric cells. These cells catch faint light rays and observe regions of space which appear dark and which can not be observed for useful astronomical studies either by telescopes or by photography.

A NEW type, cubic-shaped antenna for the 10-kilowatt television station of the General Electric Company atop a 1,500-foot mountain in the Helderberg hills region near Schenectady, N. Y., is nearing completion. Radical both in shape and design, the antenna will radiate picture-carrying waves polarized horizontally so that the signal will have more power than any existing television station in America. Using four and one half meter waves, the station, W2XB, will blanket the region of Albany and the entire capital district of New York State. Expected range of the station is about 40 miles, the distance to the horizon.

AIRLINE operation at higher altitudes during recent years—between 4,000 and 10,000 feet—has cut the number of air-sick passengers to three out of every thousand, a study announced by Colonel A. D. Tuttle, United Air Lines medical director, revealed. Records of 261,370 passengers carried on the line during the past year showed that only .59 per cent., or six out of every thousand, suffered physical discomfort during the flight. Air-sickness is less frequent than sea-sickness. Cases of ear trouble, caused by pressure changes as the plane climbed or descended, numbered but five hundredths of one per cent., or, 141 passengers in all. Colonel Tuttle attributed the low figure for air-sickness at higher altitudes to the greater smoothness of the air. Five years ago, airline publicity people estimated the percentage of air-sick passengers approached three or four per cent.