SCIENCE NEWS

Science Service, Washington, D. C.

TEMPERATURES NEEDED TO EXPLAIN STAR'S RADIANT ENERGY

UNLESS the interiors of stars are almost entirely made of iron, their internal temperatures must be as much as 1,000,000,000 degrees Centigrade, Dr. T. E. Sterne, astrophysicist of Harvard College Observatory, told the meeting of the Electrochemical Society held in Washington on October 10.

The outside surface of the sun, the hottest matter at which science can get a good look, is by comparison only about 6,000 degrees on the same temperature scale. The estimated outside temperature of other stars ranges from 1,650 degrees for very red stars to 35,000 degrees for those known as Class O.

These new estimates of internal star temperatures, Dr. Sterne pointed out, come from the theories of Professor E. A. Milne, of the University of Oxford. They exceed by a factor of 100 times the previously-held concepts of Sir Arthur Eddington, of the University of Cambridge, that the inside temperatures of ordinary stars were "merely" about 10,000,000 degrees.

Only in the case where a star is very dense, as in the baffling "white dwarf" type like the companion of Sirius, is the extra high temperature not needed, Dr. Sterne indicated. The white dwarfs have an average density 61,000 times as great as water and at their center matter probably weighs as much as five tons to the cubic inch. For such dense stars the theory of Professor Milne yields a central temperature about like the theory of Professor Eddington's—tens of millions instead of billions of degrees.

The staggering problem of internal star temperature is an essential part of one of the most important problems of astrophysics—the question of determining a reasonable mechanism which would create the enormous amount of radiant energy that the stars have been wastefully pouring out into interstellar space for at least 100,000,000 years.

Dr. Sterne indicated that in view of the findings of recent experiments on artificial transmutation of the chemical elements in laboratories, transmutation of elements from one to another within the centers of stars appears to offer the most reasonable explanation of great outpouring of stellar energy.

While the outsides of stars are constantly radiating energy into space, and consequently are not in equilibrium with their surroundings, the interior of stars might present a situation of approximate statistical equilibrium which is essential for a starting point on even the most fragmentary theory of star energy.

At temperatures of billions of degrees transmutations conceivably would be completely reversible with the elements changing from one to another in millionths of a second of time and liberating vast quantities of energy in the process.

Eddington's estimates of 10,000,000 degrees for internal star temperatures would not be sufficient for such reversible transmutations to be maintained, according to Dr. Sterne. A billion degrees, and more, are needed to explain the energy output, unless the stars consist almost wholly of iron atoms which, theoretically, can not be transmuted into other elements without absorbing—instead of liberating—energy.

SUPER-HARD GLASS MADE IN SUN FURNACE

A NEW type of "glass" of super-hardness and with high resistance to acids was reported to the recent meeting of the Electrochemical Society by Dr. Willi M. Cohn, of the University of California.

The "glass" is fused transparent zirconium dioxide (ZrO_2) having a slightly yellowish tinge. It was made by melting compressed sticks of ZrO_2 in a special sun furnace which concentrates sunlight with a large mirror and quickly raises the temperature to 3,000 degrees on the Kelvin temperature scale. Three thousand degrees Kelvin corresponds to more than 2,700 degrees Centigrade.

The zirconia glass can be heated to incandescence and dipped into cold water without cracking, is highly resistant to acids and ranks next to carborundum in hardness.

The sun furnace, with which the zirconium dioxide sticks were melted and fused, is a new step in obtaining high temperatures, Dr. Cohn reported. While it is difficult to determine exactly what temperatures such sun furnaces will create, the theoretical limit is the temperature of the sun's surface at 6,000 degrees Kelvin, or 10,000 degrees Fahrenheit.

The sun furnace, which Dr. Cohn obtained from the Zeiss Works in Jena, Germany, consists essentially of a large plane mirror which follows the course of the sun and reflects the sunlight onto a 100-inch diameter searchlight mirror with a silver backing. The heating takes place at the focus of the searchlight mirror. Arrangement is made for observation of the samples while being heated. If necessary the sample can be placed in a transparent container and its reactions studied in a reducing or neutral atmosphere or in a vacuum.

Dr. Cohn reports that "although this sun furnace means a step in advance as far as obtaining higher temperatures for exact work is concerned, it does not, however, enable us as yet to extend the upper limits of high-temperature research by more than one or two magnitudes over the older limits. Higher temperatures, in an oxidizing atmosphere, than those possible in the sun furnace may have been attained in the past, but, if so, it was for a mere fraction of a second and not for any length of time suitable for the fusion of relatively large masses of material."

GEOGRAPHIC STOCK-TAKING

GEOGRAPHIC stock-taking, not merely by nation, but by continent or even world, was urged by Dr. Isaiah Bowman, president of the Johns Hopkins University, at the

second general assembly of the Pan American Institute of Geography and History in Washington on October 9.

A new "millionth" map—that is, on a scale of one to a million—of Hispanic America, already compiled by the American Geographical Society and to be ready for the engraver by the end of 1935, was called one of the largest and probably most fruitful and practical co-operative undertakings in science.

This map makes possible a new cooperative enterprise in cartography—a new period of geographic science when continent-wide data on climate, water resources, mineral deposits, soils, rock structure, plant and animal life, human culture and population past and present, can determine national policies.

Stressing the need of cooperation, Dr. Bowman said that map-making is no longer an individual undertaking, as it once was, but a joint one, since the requirements and standards are high. The new "millionth" map of Spanish America would have taken a single individual 150 years of full maturity, skill and strength for the work. Begun in 1920, ten men per year have worked upon it, not counting cooperation of hundreds of persons and all the governments of Pan America.

The project of a new "millionth" map of the world advanced since 1909, and now covering nearly one fourth of the land surface of the globe, had to become an international undertaking.

THE VOLCANIC ZONE IN MEXICO

AN "important accident" of geography has drawn the boundary between North America and Central America right through Mexico. So scientists attending the Pan American Institute of Geography and History, meeting in Washington on October 11, were told by the director of the institute, Engineer Pedro C. Sánchez, of Mexico.

Nature's line crosses Mexico along the nineteenth parallel of latitude, which is about the region of Mexico City. South of the line is a land of volcanoes and earthquakes, characteristically Central American. North of the line is stable North America.

Dr. Sánchez described geological studies showing that the boundary line, called the volcanic zone, is not merely superficial, but is borne out by conditions deep under the earth.

Dr. Sánchez blamed ancient erosion as the probable cause of Ceneral America's earth-tremblings and smokings. Erosion of rocks and soil in the region, he explained, has created a deficiency of mass in the earth's crust. This was and is serious enough to disturb equilibrium of the earth. Meanwhile to the north an excess of mass exists. Deep within the earth the internal semi-plastic material tends to shift from north to south, endeavoring to restore balance. The earth's crust is agitated into earthquakes, and when a fault, or displacement of rock strata, is present volcanic action appears in full intensity.

STARFISH DYED BLUE TO TRACE THEIR MOVEMENTS

BLUE starfish are staring startled oystermen in the face, along the Long Island Sound oyster beds. The orthodox color for starfish in those waters is pink. The oystermen, however, are being told what it is all about, by the U. S. Bureau of Fisheries. The starfish have been dyed blue for the same reason that migrating birds have aluminum bands fastened about their legs—to tell where they came from, and how far they have traveled.

Starfish, as is well known, are among the worst enemies oysters have. They fold themselves over the oysters' shells, smother them until they open up, and then devour them. They devastate oyster beds by the square mile in this way.

During the recent session of the Congress, funds for the scientific investigation of starfish and other enemies of oysters were appropriated, and research begun at several points. One of the things Victor Loosanoff, of the bureau, wanted to learn was the rate of starfish travel —for starfish can move, despite their not-very-motile appearance.

But it proved impossible to fasten on them the customary types of tags or bands. They could wriggle out of any kind of knot, and if a tag were stapled right through an arm the starfish calmly shed the arm and grew another. Starfish can do that kind of thing pretty easily. But a starfish can not get outside its own hide so easily, so the scheme was finally hit upon of dyeing them a conspicuous color and then turning them loose in thousands. Nile blue, a powerful anilin dye, proved well adapted for the purpose. One ounce of the dry powder provides enough solution to stain more than 25,000 starfish blue. The process is very simple. The captured stars are dumped into the dye-vats for about a minute, held on deck for an hour, and pushed back into the sea. It costs far less, in both money and time, than any other method of "tagging" living specimens.

Oystermen and all other persons finding blue starfish are requested to write to the U. S. Bureau of Fisheries Laboratory at Milford, Conn., stating the exact location, depth of water and time of capture.

SANDALWOOD, HAWAII'S MOST VALUABLE TREE

SANDALWOOD, theme of a thousand romances and poems of early commerce, is being groomed for a comeback in the forests of Hawaii. It once existed there in great quantities, but over-exploitation 125 years ago by an alliance of traders and native potentates almost wiped it out.

The forests were devastated at that time because of the high prices that could be secured in China for this sweet-scented wood. They promise to be reestablished because that price still maintains.

C. S. Judd, territorial forester, some years ago secured from Mysore, India, seeds of what is held to be the most valuable species of sandalwood. He planted these seeds on a ridge in the suburbs of Honolulu and they grew abundantly. To-day there are some 1,500 three-year-old trees on this ridge. They are bearing all the seed that is needed for nursery use. Aside from these, an old sandalwood tree is occasionally found in some remote mountain canyon.

Mr. Judd is developing much nursery stock, based on

this seed supply and with the aid of C.C.C. men as a labor supply. He is finding, however, that sandalwood trees present certain peculiar problems in their propagation. A seed planted in a pot will sprout and grow normally for six months and then, unless it is given a peculiar variety of aid, it will languish and die. The plant is a semi-parasite. Its roots fasten themselves on the roots of neighboring plants and steal a considerable portion of their nourishment from them. Unless there are proper host plants, they will not survive.

In the pots at the nurseries in Hawaii ironwood seeds are planted with the sandalwood. When the little plants are set out in the open, the ironwood plants go along. Thus they continue to contribute to the support of this valuable but somewhat lazy tree. In its native state the sandalwood always grows among other trees and helps itself to aid from their roots, as a partial parasite. On the ridge that overlooks Honolulu where 1,500 young trees are growing vigorously they stand among lantana bushes, members of the verbena family.

Sandalwood trees grow rather rapidly. They are of some value at the age of 25 years. It is the heart of the tree, however, that is most precious, and heart-wood is not likely to develop greatly until the tree is 40 or 50 years old. Since the present plantings are chiefly in territorial forests, however, the profits do not need to be immediate to make the enterprise sound.

CONTROL OF MOSQUITOES IN NEW JERSEY

NEW JERSEY'S mosquito fighting legions look back with more than ordinary satisfaction upon the results of the season's campaign now ending. They have proved their new type larva-killing compound to be able not only to kill "wigglers" in their pools and puddles, but to bring to grief whole squadrons of adult mosquitoes actually on the wing. It can also render any given area untenable to the pests for periods of from two to four hours, just as some of the war-chemicals used in human conflict can make an area of field or forest impossible of occupation by enemy troops.

The New Jersey larvacide is a mixture of light petroleum oil and pyrethrin, an extract from the pyrethrum flowers long used in the making of Dalmatian insect powder. The addition of this active principle to the oil so increased its effectiveness that now four or five gallons will produce as large a killing film as used to be obtained from 35 to 40 gallons. With the addition of a little soap, a perfect emulsion can be made with ten or twelve times its bulk of water.

It was developed at the New Jersey Experiment Station. Although it is protected by a patent against commercial monopoly, no restriction is placed on its use, and all inquiries are being answered by the Department of Entomology.

To render land areas untenable by mosquitoes, a power sprayer is used, producing a fine mist of the emulsified larvacide. This spreads over earth and vegetation and clings closely for several hours, making the neighborhood unbearable for mosquitoes, but entirely comfortable for man and his domestic animals. It can also be applied with a hand sprayer, to repel mosquitoes from porches and other unscreened haunts of man. For use over water, sprayers mounted on airplanes are employed.

The new larvacide was found to meet four of the five requirements of an ideal larvacide which Dr. Thomas J. Headlee, entomologist at the experiment station and leader in the long fight against the "Jersey Pest," had set forth several years before. It quickly destroys all mosquito larvae with which it comes in contact, it is non-poisonous to higher animals and man, it is not injurious to water plants, and it is cheap enough to render its use practicable. It fails to meet only the fifth of Dr. Headlee's requirements: It does not remain effective throughout the season. However, attention is now being devoted to improving the lasting qualities of the larvacidal film.

ITEMS

THE search for better types of anti-aircraft targets has long been a pressing problem among the great powers of the world. U. S. S. R., with its current emphasis on gliders and parachute jumping, has been reported by its news agency Tass to have developed a system whereby a train of gliders are towed aloft by an airplane and then cut loose one by one to be shot at by anti-aircraft guns on the ground. The glider pilots set the course of the gliders and then jump safely to the ground. The new British system of using high-speed airplanes operated by radio control, while more costly, would appear to bring much more reality into the target practise.

"ROCKETS" of luminous bacteria, that shine with cold light of their own making, were shown in a unique bioluminescent exposition held in Vienna recently, under the direction of the biologist, Professor Hans Molisch. The "rockets" were set off in spiral glass tubes filled with a suspension of luminous bacteria in a nutrient fluid. The ends of the tube were sealed shut, with enough spare space to accommodate a good-sized bubble of air. When the tube was inverted, the bubble rose to the upper end, disturbing the bacteria and exciting them to luminescence. Recently, as a "stunt," one of Professor Molisch's students illuminated the great hall in the Paris Oceanographic Institute with a battery of "bacterial lamps." The light was faint, but sufficient to see by. Over forty species of luminous bacteria are known to science, shining in all colors from deep green to bright yellow. Most of them are found on marine fish.

NEON lamps, running on the same principle as the red-glowing American street signs, have proved far more satisfactory than the conventional incandescent lamps for use in forcing plants and flowers in the experimental greenhouses of the Agricultural College of Wageningen, The Netherlands. They are more economical, partly because they convert a far greater proportion of the electric current into light and waste less as heat, and partly also because their light is rich in the yellow and red wave-lengths that are most stimulating to the action of chlorophyll in the green leaves. Among the plants so far tested have been cucumbers, strawberries, begonias and a number of other flowers. In some of the experiments an extra supply of carbon dioxide gas was artificially administered.