SCIENCE NEWS

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A NEW SUPER-DENSE STAR

A NEW addition to the rare class of white dwarf stars, which have densities as much as a million times that of water, has been announced by Dr. G. P. Kuiper, of the McDonald Observatory of the University of Texas and the University of Chicago.

It is in the constellation of Cygnus, the swan, just above the top of the familiar "northern cross," visible in the western evening sky. The star, known by its catalogue number as Ross 198, is of the fifteenth magnitude, and not visible except with the largest telescopes.

The faint companion to Sirius, the "dog star," now seen in the evening to the southeast, was the first white dwarf to be discovered. Though it has as much stuff in it as the sun, this is concentrated into a globe about as big as the planet Uranus, one thirtieth of the sun's diameter. Thus, a pint of its material would weigh about 20 tons.

Explanation of this super-density is believed to be that the atoms are completely ionized, or broken into bits, by the extreme temperatures that prevail inside, about two billion degrees Fahrenheit. Thus, the wood in a pile of boxes, corresponding to the atoms and like them containing a great deal of empty space, takes up a lot more room than if the same boxes are broken into small pieces.

Just how dense is the newly discovered white dwarf, Ross 198, remains to be determined. However, another star of the same class that Dr. Kuiper discovered a few years ago is estimated to be a thousand times as dense as the companion of Sirius.

THE ANNUAL EXHIBIT OF THE CARNEGIE INSTITUTION AT WASHINGTON

EXPLODING stars, known to astronomers as "supernovae" and described as "the rarest and most spectacular phenomena recorded in the study of the observable region of the universe," are of two types. This is shown by a survey conducted jointly by the Mount Wilson Observatory of the Carnegie Institution of Washington and the Palomar Observatory of the California Institute of Technology. Some results of this investigation, of which the exploratory phase is now completed, is shown in the annual exhibition of the Carnegie Institution of Washington, opened on December 13.

Ordinary "new" stars reach a maximum brightness only about 100,000 times that of the sun. Such a star, says the catalog of the exhibition, "becomes unstable, swells up, and blows off its cover." Several of these occur each year in our own Milky Way system, and presumably they are about as frequent in the millions of similar systems observed by astronomers. In the more distant ones, even when brightest, they are not sufficiently brilliant to be apparent.

Until the joint investigation was inaugurated, six years ago, only fragmentary information about supernovae, which are far more brilliant, was available. Now it is found that one appears in each star system about once in three to six centuries. The last in our system was in 1572.

"All well observed supernovae seem to follow closely one of two patterns," it is announced, "and are distinguished as groups I and II. Those of group II are the fainter (average maxima about 10,000,000 suns) and their spectra, that is, analyses of their light, resemble the spectra of normal novae on an enhanced scale. Practically all the features in the spectra have been identified. The spectra of group I (average maxima about 100,000,000 suns) are quite different, and so strange that scarcely a single feature has yet been identified with certainty. These spectra evidently reflect the sudden release of energy on an enormous scale, and their final interpretation should contribute information concerning the behavior of matter under extreme conditions."

Pressures in the laboratory as great as three million pounds per square inch, which duplicate those at a depth of 300 miles below the earth's surface, or about a twelfth of the distance from surface to center, are proving a powerful new tool in studies of what is happening in the earth itself.

First results of researches made with such pressures in the Geophysical Laboratory of the Carnegie Institution of Washington will be shown at the annual exhibit of the institution.

To obtain such pressures it is necessary to have a material that will withstand them. Tungsten carbide, known as carboloy, is one that has been widely used, but even with this the trick of "a bomb within a bomb" is needed.

"A carboloy piston 1.13 inches in diameter (roughly one square inch in cross section) will support a load of about 375 tons before rupture," it was stated. "It is one of the strongest known materials. This compressive load thus appears to set up an upper limit to the pressure obtainable in a single-stage apparatus. If, now, we support this piston laterally by a pressure of, say, 250,000 pounds per square inch, on the basis of ordinary elastic theory we can expect the piston to support a load of about 500 tons as an upper limit. Actually, however, it will withstand much more than 500 tons, because the lateral confining pressure acts also to increase its strength. A piston supported in this manner withstands a load of as much as 1,500 tons.

"This phenomenon has been utilized in the apparatus for work at very high pressures. The apparatus consists of a two-stage or cascaded arrangement of pressure vessels, that is, a bomb within a bomb. A pressure of 300,000 pounds per square inch developed in the first stage or outer pressure vessel acts on the second stage or inner pressure assemblage to support and also to strengthen it, and thus allows the generation of a pressure about ten times that in the outer vessel. The advantage of this two-stage cascade apparatus, therefore, lies not only in the circumstance that the second stage immediately doubles the pressure range, but also in the great increase of strength caused by the confining pressure on the inner

bomb. The pressure in each stage is developed by means of a piston, and the mechanism is so designed that the pressure in either stage may be varied independently of the other."

COLD LIGHT FOR TELEVISION

THE woods are spooky when decayed tree branches become phosphorescent and glow in the dark. In much the same way, faces of clocks shine in the night if the hands and figures of the hours are phosphorescent. And everyone is familiar with the uncanny gleam of the cat's eyes as they "shine" in the darkness. While the cat's eye merely reflects light, the "eye" or screen of the tele-receiver actually produces "cold light."

This result is based on luminescence—"light emission not directly attributable to heat." Radio now takes up the age-old art of luminescence, applying it to man's conquest to "see at a distance." For the art of luminescence, optics and lenses, radio research promises much that is new. They are keys to the future of television.

Having caught the clue that tiny crystals of specially synthesized luminescent materials have the unique property of transforming electron energy into light, the research experts, now fashioning kinescopes or "tele-eyes," are studying the historical, theoretical and practical features of the effect.

Revealing hitherto unpublished data, Humboldt W. Leverenz, of the RCA Laboratories, states that the art of luminescence is having a rebirth, although synthetic luminescent materials have been known for 337 years. He explains that the term "cold light" is concisely descriptive of these "glow materials." And he goes on to point out that in television a scientific word—"cathodoluminescence"—comes into prominence. The name is derived from the fact that light emission is occasioned by cathode rays or electrons, which are electricity in buckshot form, that impinge on luminescent matter.

Alchemists were a long, long way from television when, in 1603, they synthesized phosphors by crude methods, such as by heating oyster shells with sulphur to produce a feeble violet-phosphorescence. Now, along comes television to accelerate the old oyster shell technique. The intense search of literature on the subject of luminescence has disclosed, according to Mr. Leverenz, "a plethora of phosphor recipes," but few work successfully.

First of all, to serve on the eye-like screen of radio, a luminescent ingredient must be pure; in fact, it must possess a degree better than "spectroscopic purity," as Mr. Leverenz describes it. To the visitor the laboratory looks like a hospital operating room. And, incidentally, the air is kept so pure that a burning gas flame is invisible; there are no impurities to burn.

To show the complexity of the trick, Mr. Leverenz calls attention to the fact that there is no theory of luminescence adequate to explain quantitatively all the properties of known phosphors, or to predict the properties of new ones. But he does know that in regard to luminescence, so vital in television, all efficient phosphors are definitely crystalline. But those intended for the kinescopic "eye" must give off light of a color that the eye can easily see, if maximum efficiency is required. Therefore, all phosphors are not suitable for television.

Many factors must be taken into consideration in fashioning retinas for television. Evidence that eleven years of intensive television-luminescence research in the RCA Laboratories have been rewarded with success is found in the statement by Mr. Leverenz that the kinescope now can provide high enough levels of flicker-free picture brilliancy to be adequate, not only for the normal eye, but also for the defective eye. He quotes statistics to report that approximately two fifths of the population, comprising millions of people, have defective visual functions which must be considered in establishing a public service such as television.

GLYCERINE FROM PETROLEUM

GLYCERINE, the important industrial chemical used in the manufacture of explosives for America's defense program as well as in more peaceful pursuits, such as the manufacture of resins for varnishes and lacquers and the processing of tobacco, can now be made from petroleum. Dr. E. C. Williams, vice-president and director of research of the Shell Development Co., Emeryville, Calif., speaking at the New Orleans meeting of the American Institute of Chemical Engineers, described the new process.

At present obtained as a by-product from the soap and fat-splitting industry, the price and supply of glycerine have been subject to wide variations. In 1917 it rose to 70 cents per pound and was difficult to obtain even at that figure. At that time it was made in Germany by a fermentation process, to the extent of about 13,000 tons annually, but this method involved many commercial difficulties.

The first step in the Shell process is the isolation of a gas, propylene, from the petroleum. Then comes a reaction with chlorine gas to form allyl chloride. This is treated with caustic soda to form allyl alcohol. In an alternate step, glycerine chlorhydrin is formed instead. The last step is the production of glycerine from one of the last two products.

In explosives manufacture the glycerine is treated with nitric acid to form nitroglycerine. This is used to make dynamite and also some military explosives. The British explosive, cordite, also requires glycerine in its production.

Dr. Williams stated that the glycerine produced by the new method "is of excellent quality, meeting easily the specifications of the most rigorous user with whom we have yet come in contact."

NUTRIENTS FOR PLANT ROOTS FROM DRY SOIL

THE classic theory that plants can draw mineral salts only from a liquid solution has been disproved by Dr. Hans Jenny and Roy Overstreet, of the College of Agriculture of the University of California, who have shown that plant roots have the power, under certain conditions, actually to secure nutrients directly from dry soil particles.

This discovery was made during a study of the absorption of radioactive potassium and sodium by plant roots. Radioactive atoms of nutritional elements, produced in

the cyclotron, have made it possible to learn much about plant life, and is particularly valuable in the study of plant nutrition.

Charged atoms of potassium and sodium were combined with the regular elements and mixed in the soil surrounding test plants. By use of a vacuum-tube tracing device, the irradiated atoms can be followed; from the soil, through roots, up stems and into leaves or whichever part of the plant finally absorbs the elements.

Dr. Jenny and Mr. Overstreet found that when a root surface came into close contact with a clay particle coated with potassium or sodium atoms, these began to be absorbed directly into the root cells. It was not necessary for them to be first dissolved in water in the soil.

The commonly accepted view held for many years has been that nutrients held in soil are dissolved by water into what is known as the soil solution, and that all plant food is absorbed from this solution. This new discovery now shows that while this action is undoubtedly very important, it does not explain all conditions under which plants take food from the soil.

TROPICAL AMERICAN DIET

THAT food and nutrition should be a "must" item for consideration in a program for Western Hemisphere solidarity, was pointed out by Dr. George R. Cowgill, associate professor of physiological chemistry at Yale University, in a De Lamar lecture at the Johns Hopkins School of Hygiene and Public Health.

Many of the dietaries in common use in Tropical America are "far from satisfactory in several respects," Dr. Cowgill found from his own observations during two summers in Panama and other Tropical American countries. Dr. Cowgill made his studies of the possibilities of nutritional research among the natives in Panama at the request of Dr. Herbert C. Clark, director of the Gorgas Memorial Laboratory.

Tropical American diets lack calcium and vitamin A particularly, Dr. Cowgill found. Advice to consume more milk to make up the calcium deficiency would be impractical because a dairy industry is practically non-existent except in particular sections of Tropical America.

The Mexican Indians use lime in removing the bran layer from the corn kernel and this results in addition of calcium to the final edible product, probably accounting partly for the splendid condition of the teeth seen in most of these people. Dr. Cowgill suggested that other Tropical Americans might be helped to get more calcium in their diets by development of other similar uses for lime. He believes that better returns on American capital invested in development of natural resources in Tropical America can be obtained from improvement, through food and other means, of the health of the local tropical laborers.

"If the purely humanitarian consideration of improvement in the health of all groups of people, regardless of locality, race and other considerations, does not constitute sufficient reason for becoming interested in nutritional problems of Tropical America," he said, "then I offer the one just stated which is related definitely to an enlightened self-interest and a matter of dollars and cents."

ITEMS

GATHER acorns, horse chestnuts and beechnuts to eke out the feedstuff supply for farm animals and thereby release tonnage for other needed imports, is the suggestion in *Nature* of Dr. R. Melville, of the Royal Botanic Gardens at Kew. Both oaks and horse chestnut trees have borne bumper crops this year and in the present national emergency they should not be permitted to go to waste. Horse chestnuts are slightly bitter, but most farm animals soon come to like them. Only pigs persistently refuse them. They can be fed "as is," but it is considered best to gather them in quantities in central depots where they can be dried and ground. Acorns can be stored in underground pits, where they will keep very well for a long time, if they are not permitted to get wet. They can be fed fresh or dried, but it is not recommended that they be given to young animals, which are sometimes poisoned by them.

WOOD can be converted into an easily bent and molded plastic by a new process developed at the U. S. Forest Products Laboratory at Madison, Wis. Worked into any desired shape while hot, the plasticized wood becomes as stiff and strong as ever upon cooling. The new treatment is a by-product of the research on the chemical seasoning of refractory woods. It was found that oak, soaked in a concentrated solution of urea and then dried, became plastic when heated to about the boiling point of water, though the wood was still dry. It remained plastic while hot, and resumed its normal "woodenness" upon cooling. Sawdust and chips, similarly treated, can be heated and pressed into any desired shape. This material is self-bonding, that is, it sticks together without the addition of any outside adhesive. Thus far, the new process has been used principally on hardwoods, particularly several species of oak. However, preliminary experiments indicate that softwoods like juniper and Sitka spruce will also give good results under the same treatment. Patents covering the new process have been applied for by the Forest Products Laboratory.

THE Forest Service keeps close track of the cost of suppressing forest fires. In 1934, a fire in the Nezperce National Forest in northern Idaho cost $12,000 to put out, when fire-fighting crews moved in by truck and on foot. During the fire season just closed, another fire occurred in the same area. This time two parachute jumpers formed the spearhead of the attack, and the cost was held down to $500. Another comparison was made even more directly, when ten fires were reported in one day, on the Bitterroot National Forest in Montana. Two of them, in inaccessible areas, looked as though they might become bad ones, so planes flew over and dropped crews of "smoke jumpers," with tools and provisions. The other eight were attacked in the orthodox manner, by crews going on foot from roadheads. It cost only $160 each to suppress the fires attacked by the parachutists. The ones put out by ground crews alone cost from $2,000 to $17,000 apiece.