SCIENCE NEWS

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THE BASIC CONSTANT OF ATOMIC PHYSICS

DEEP down in a tiny, sub-basement laboratory at the Johns Hopkins University a large diamond slab—that would cost you $4,000 on the open market—is being used to probe the fundamental constants of the physical world.

Did you ever hold a flawless $4,000 diamond in your hand knowing that if you dropped it to the floor it might chip or shatter? Probably not. But you can realize that you don't hold it, you clutch it.

And yet clutching is difficult, for the Johns Hopkins diamond has a slippery surface because it is ground smoother than ever a diamond has been ground. One surface is plane to within a tenth of the length of a green ray of light; or about one five-hundred-thousandth of an inch.

"Here it is," said young Professor J. A. Bearden, Hopkins's x-ray expert, as he handed me a test-tube filled with a brownish fluid. And there, floating in the fluid, was a shimmering three-carat diamond slab as big as the nail on a man's little finger. Yes, the diamond was floating. "You see," explained Professor Bearden, "we have to know the density of this diamond. One way to determine the density is to make up a special solution just as dense as the diamond so that it will neither float nor rise in the tube. So delicate is the balance that if I place my hand on the test-tube, and warm the solution slightly, the diamond starts to sink. The heat of my hand expands the liquid, makes it less dense and so the diamond starts to sink because it is relatively more dense. If I want to make the diamond rise again I reverse the process, immerse the liquid in cold water, make the liquid more dense so that the diamond becomes, relatively, lighter than the liquid and rises."

Using a little hook, Professor Bearden snared the diamond and lifted it out of its brownish bath, washed it out and put it in my hand. Its surface seemed slippery because of its smoothness. Gingerly I held it up and saw the brilliant gleaming colors of refraction in the flawless gem. And then quickly I laid it down on a convenient black cloth.

One corner of the diamond is used as a tiny prism to bend, or refract, x-rays. By knowing the amount of refraction of the x-rays—and a lot of other details too—Professor Bearden is able to calculate the value of the very important physical constant known as "e over m": "e" stands for the charge on the electron and "m" for the mass of the electron. As the physicists write it, "e/m", appears again and again in the equations of atomic physics. So important is the constant that scientists are ever searching for different ways of determining its value. In fact they seek to check measures made by one method against those made by another to get the most exact determination possible. Professor Bearden uses the x-ray refraction method to provide a new and more accurate determination. His scientific report, describing his discoveries, appears in the current issue of *The Physical Review*.—ROBERT D. POTTER.

HYDROGEN AND THE SUN'S HEAT

THE end of the world will come when the amount of hydrogen in the sun becomes only a few per cent. less than it is now, according to a statement made by Dr. George Gamow, professor of theoretical physics, in a lecture at George Washington University. But it will be difficult to observe any climatic changes for a long time due to the gradual increase in the sun's heat.

Yet, despite this present comforting picture, the sun is bound eventually to become 100 times brighter than it is now, when the hydrogen content falls only slightly. "Such a brightening of the sun," declared Professor Gamow, "will necessarily lead to the melting of the earth and, of course, the disappearance of life."

In his lecture on "The Evolution of Stars," Professor Gamow showed that transmutation of the elements—and particularly the transformation of hydrogen into helium—accounts for the enormous amount of radiant energy liberated by the stars and our sun. Temperatures of several millions of degrees are attained inside stars.

The rate of the reactions of atomic nuclei, leading to the energy production, depends essentially on the mass of the star. Very heavy stars, with masses several hundred times as great as the sun must be very bright and hot. They are known as "blue giants" to astronomers. Stars of very small mass are faint and reddish in color and are called "red dwarfs."

The eventual density of our sun, after it has long since melted the earth, is gradually to become an absolutely dark and cold body of very high density. This will occur after the sun passes through a period of maximum brilliance which it is now, very slowly, approaching.

THE PRINCIPLE OF THE ECHO ALTIMETER

THE single most important contribution of the year 1938 to safer flight—the absolute altimeter, which shows height above the ground rather than height above sea-level and thus warns a pilot of obstacles—kicked around inside the heads of scientists and engineers for years because radio equipment that could make it work did not exist.

The patent, No. 2,045,072, covering the absolute altimeter which, if it works as it gives promise of, will do more for safe flying than any other single development under way, was granted to Lloyd Espenscheid, of Kew Gardens, Long Island, N. Y., on June 23, 1936. But the original application for a patent to protect the idea on which it is based was made more than eight years ago, on April 29, 1930. The patent was assigned to the American Telephone and Telegraph Company.

Actual development work on the device did not begin until January, 1937, when Peter C. Sandretto, communications engineer of the United Air Lines, approached the telephone company to ask for their cooperation in the development of a method to warn their pilots of approaching obstacles. Had the airlines had such a device, a survey of accidents during the last few years shows, more than half the disasters that have marred the record of

American aviation would not have occurred. The reason for the delay—between 1930 and 1937—lies in the fact that the new altimeter uses ultra high frequency radio waves. Transmitting equipment from these very short radio waves has been developed only recently.

A 500-megacycle radio wave is transmitted from a small T-shaped antenna on the underside of the right wing. On this wave is impressed an 80-cycle audio frequency wave. This combined wave is sent earthward and is reflected by the earth back to the plane, where it is picked up by a similar antenna under the left wing. A portion of the transmitter's output goes directly to the receiving antenna. The device essentially counts the number of 80-cycle beats occurring between the time the direct wave is received and the time the reflected wave is received. The 80-cycle audio frequency wave is impressed on the 500-megacycle carrier wave because the former is easier to count—the apparatus is much simpler. The ultra high frequency carrier waveband is used because it is free from static, can be directed more easily and because of its limited range. A recessed housing for the antennas, to cut down wind resistance, will be possible on new planes, but not on existing craft. Its use on existing craft will entail a slight loss of speed, but, on the other hand, a much greater gain in safety.

Accidents that would have been prevented, had such a device been available, include the disaster to the *Lockheed 14*, which crashed into a mountain near Los Angeles this year; the two planes lost in recent years near Saugus Gap, near Los Angeles; the T.W.A. plane lost near Fresno; the planes that have been lost in Wyoming and Utah, as well as others.

Further testing is necessary. In addition to that Western Electric engineers, who are in charge of the development, will require about five months to get set for making the equipment. A year in all will be necessary before airliners on regular scheduled runs can use the device.

Working with Mr. Sandretto on the device has been Russell Newhouse, of the Western Electric.—LEONARD H. ENGEL.

CULTURE OF MEN OF THE STONE AGE

STONE AGE men all the way from China to India and south to Java had the same general type of culture and used much the same kind of tools, it is indicated by results of the American Southeast Asiatic Expedition, published in the *Proceedings* of the National Academy of Sciences by its field director, Dr. Hellmut de Terra.

The expedition has concluded its exploratory work in Burma, which seems to be a connecting bridge uniting the three corners of this great triangle of ancient culture. As reported by one of Dr. de Terra's colleagues, Dr. Hallam L. Movius, it is not yet certain whether the civilization they studied originated in China and spread westward and southward, or whether it started farther south and made a three-direction spread.

The stone tools used by these ancient peoples are of the crudest type of workmanship. They included choppers, scrapers and (except in India) fist axes. In Burma, a favorite material was petrified wood. Associated with the human artifacts were bones of elephant, rhinoceros, hippopotamus, buffalo, horse and deer.

After the expedition had finished its work in India, the members, who included Dr. Teilhard de Chardin in addition to Drs. de Terra and Movius, went to Java where they visited Dr. G. H. R. von Koenigswald, who is investigating the sites of Pithecanthropus finds under the auspices of the Carnegie Institution of Washington.

The third Pithecanthropus skull, recently discovered by Dr. von Koenigswald, has at last set a geologic date for this ancient race. Hitherto not definitely dated, the Java Ape-Man has now had his time set as mid-Pleistocene, that is, about the middle of the Ice Age, some half-million years ago.

ANTI-CANCER VACCINATION

THE dream of finding a way to vaccinate against cancer is one step closer to becoming a reality or to being finally and definitely proved to be nothing but a dream. Which way the dream will turn out may be determined by studies now under way at the Rockefeller Institute for Medical Research. The first step toward making anti-cancer vaccination either a glorious reality or a lost hope is reported by Dr. John G. Kidd, of the institute, in the forthcoming issue of *The Journal of Experimental Medicine*.

One kind of cancers or tumors, the papillomas of rabbits, are known to be due to a germ of the virus type. This germ or virus, Dr. Kidd has now found, is strikingly similar, in its ability to induce resistance or immunity to itself, to other germs against which vaccination is successful. It acts like the classical antigens of other disease germs which call up the germ-fighters of the body known as antibodies. It is because of such antigens that vaccination or immunization against smallpox, diphtheria and a few other diseases is possible.

Discovery of such an antigen substance in rabbit papillomas means that it should be possible to protect rabbits from these tumors by a sort of vaccination. Whether the same can be done for other kinds of tumors, including human cancer, depends on whether such antigen substances in the tumors can be found. Search in this direction, Dr. Kidd reports, is now being made. The results should provide the final word on the possibility of anti-cancer vaccination.

TRIMETHYLAMINE

A WIDELY found organic compound known to chemists as trimethylamine, present in many plants and animals, has been shown by Professor Laszlo Havas, of the University of Brussels, to have physiological action like that of a sex hormone. Professor Havas has reported his experiments in *Nature*.

The chemical is highly active, producing marked results in dilutions as weak as one part in 25,000, or even one part in 60,000. Injected into the stems of young tomato plants, half an ounce or so of the solution produced an increase by 22 per cent. in the number of flowers. Frogs placed in a trimethylamine solution moulted their skins and prepared for mating activities, even though the mating season was three months past. Other amphibians

similarly treated also showed signs of having their mating instincts roused.

The substance is somewhat poisonous, however, and the treatment had to be discontinued after a few days lest the animals be harmed. The solution also stimulated the growth of plant tumors in tomato stems that were first inoculated with the bacteria that cause plant cancers, and then treated with the 1: 60,000 concentration.

FOLSOM MAN

UNEARTHING a mammoth tusk at the now-famous summer camp of America's Folsom Men in Colorado, Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution, has the first evidence that shaggy elephants were hunted around this prehistoric camp ground.

According to Dr. Roberts, these elephants were alive during the closing days of the last Ice Age, at least 10,000 years ago. The extent of their camp, and quantities of stone implements and débris of meals, tell of hunters who returned year after year. Their game is identified as herds of bison, musk-ox and camel that browsed in pastures where streams flowed from the melting glaciers.

New discoveries this summer include several new kinds of knives and scraping tools, all unmistakably like the workmanship of America's other Folsom Age hunters. Many of the hunters' crude attempts at art have been unearthed, indicating that in this early era American art was merely geometric lines scratched on bone.

Although Dr. Roberts has sought tirelessly for bones of the hunters themselves, the Folsom Men in Colorado and elsewhere in America continue to be ghostlike figures known only by their trail of characteristic weapons and tools and the bones of animals they killed.

Dr. Roberts also investigated two reported sites of Folsom Man in Wyoming and in Canada, finding typical Folsom weapons as far north as Saskatchewan. Tracing the hunters into the north country may eventually clear up the question as to when America was first inhabited, that is, whether man arrived early in the last Ice Age, before glaciers closed the available corridors from the north, or whether they waited until the ice melted enough to provide a route where game and plant life existed. According to another theory, a corridor east of the Rockies remained ice-free, affording passage into America at any time during the last Ice Age.

ITEMS

A LIFE-SIZED figure of a normal woman, made out of translucent material, will show visitors to the New York World's Fair next summer how cancer spreads from the first small lump on a woman's breast to other parts of the body, unless that dangerous first lump is promptly removed. The "Cancer Woman," designed by and constructed under the direction of John L. Broomfield, of the New York Museum of Science and Industry, will be given a public pre-viewing at the museum during November and December. The woman's figure is part of the special cancer exhibit which has been prepared for the Fair under the direction of Dr. Francis Carter Wood, of the Institute of Cancer Research of Columbia University.

A WHITE bison bull, an animal rarer than the sacred white elephant of Siam, is an inmate of the National Zoological Park at Washington. It was born on the National Bison Range near Moiese, Mont., and was presented to the park by the U. S. Biological Survey. White bison were great rarities even in the days of the vast herds on the western plains, a couple of generations ago. The Indians considered them sacred. One plains tribe, the Atsina, used to kill large numbers of bison by driving them over cliffs. But if they found one white animal in the mass thus slaughtered wholesale, only the direst necessity could drive them to take the meat or hides of any part of the whole herd.

THE National Bureau of Standards and the American Dental Association have been working together for a score of years to provide American sufferers from dental decay with more enduring teeth. A list of dental repairing products that have been checked by the bureau in cooperation with the dental association is to be published in the association's journal for the month of November. Dental cements, amalgams, gold alloys, tooth-matching filling cements and accessory materials will be listed by name in the journal, following tests designed to show how well they stand up and what the patient gets for his money. As with the American Medical Association in the case of remedies and instruments, members of the dental association are expected not to use products which are condemned. The list represents twenty years of research at the bureau. Funds of the American Dental Association have been used since 1928 to support the study, which is being carried on continually to check old products and test new ones.

AMERICAN consumption of tin, a strategic material which must be imported and most of which comes in fact from the Malay States, rose by nearly 7,000 long tons during 1937, according to the U. S. Bureau of Mines. Tin consumption amounted to 90,137 tons of both primary and secondary tin during 1937 as against 83,050 tons in 1936. Four fifths of this was virgin tin, the consumption of which also increased. The world's main source of supply, in the Malay States, is now under British domination, but is within striking distance of the expanding Japanese empire.

THE Palisades of the Hudson River were once huge lava beds which have withstood weathering until they now rise predominant above the surrounding terrain of the Hudson River Valley, according to Professor S. J. Shand, of Columbia University. He will lead a field trip to the Palisades during the coming meeting of the Geological Society of America in New York City. The Palisades sill, as it is known, is several hundred feet thick. It was formed about 160,000,000 years ago by a flow of lava which forced its way upward and between hardened beds of sand and clay previously laid down by ancient streams and lakes. Erosion gradually removed the overlying sand and clay and left the towering scenic cliffs.