SCIENCE NEWS

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THE WAVE LENGTH OF ATOMS

AT the Bartol Research Foundation, at Swarthmore, Pennsylvania, a stream of atoms has been made to behave like immaterial waves scattered in many directions.

Dr. Thomas H. Johnson, of the Franklin Institute, Philadelphia, has fired a stream of hydrogen atoms at the surface of a crystal of lithium fluoride and by observing the spread of the reflected atoms has found the wave length of the atoms and has learned how the network of atoms on the crystal surface is fitted together.

This discovery is the latest development in the great new branch of physics inaugurated in 1924 by the French nobleman and scientist, Prince Louis de Broglie, who first proposed to give matter the properties of waves. The revolutionary new wave mechanics, which threw many of the cherished notions of the nineteenth century overboard, has grown with amazing speed since its birth at the hands of de Broglie and now is the main weapon of investigators in attacking the intricate problems of the structure of the atom.

The present experiments confirm these new theories of the wave-like behavior of all matter. The beam of atoms reacts with the surface in much the same way as would a beam of light waves. It is, in scientists' language, "diffracted."

This sort of thing was never suspected until the arrival of the quantum theory in physics on which, for instance, television and the talking movies depend. A beam of light was supposed to consist of waves. On the other hand, atoms or electrons in motion seemed to be like bullets.

This simplicity is all confused now. Light entering a photoelectric cell seems to act like a stream of particles, and it has been shown by two physicists of the Bell Telephone Laboratories, Drs. C. J. Davisson and L. H. Germer, that even electrons, those lumps of negative electricity which make the electric current, might, under special circumstances, behave like waves. These inconsistencies have led physicists to think that the distinction between lumpy particles and smooth tenuous waves was not so clear as they had thought.

Dr. Johnson's present experiments supply the last link in this chain of contradictions. He found that even atoms of hydrogen, apparently the most material of things, may become immaterial enought to act like waves breaking on a rocky shore when they are fired at the regular lattice work of a crystal. The atom waves are very short; that is, the distance from crest to crest of the waves is only about the diameter of an atom, one hundred millionth of an inch.

X-rays have been used for some time to explore the interior of crystals. The shortness of the new atom waves enables them to do still more and disclose even the small irregularities of the surface.

Before this work a crystal was regarded as made up like a super chess board with some four thousand million million squares on the square inch. Dr. Johnson's work shows that minute cracks break up the large board into a multitude of small ones having some four hundred squares on each. Enough atomic chess boards to take care of a gigantic chess match in which every member of the human race engaged are to be found on an area of about one ten-thousandth of a square inch of crystal.

COMET DISCOVERED ON 1902 PHOTOGRAPHS

THE remarkable Schwassmann-Wachmann comet which varies in brightness and remains in view of the earth throughout its circumnavigating of the sun existed at least twenty-five years before its discovery by the German astronomers at Hamburg in 1927.

Leland E. Cunningham, of Harvard College Observatory, has discovered that a comet found by Dr. Karl Reinmuth, of Heidelberg Observatory, on photographic plates made in 1902 is the same as the now famous Schwassmann-Wachmann comet. The official announcement of identity of the two objects will be contained in Harvard College Observatory announcement, 159, now being mailed to astronomers throughout the world.

The famous comet that is named after its two German discoverers is unusual because it has a nearly circular orbit, remains more than half a billion miles from the sun traveling between the orbits of Jupiter and Saturn, and undergoes sudden variations in brightness.

For a comet it has an unusual behavior in its brightness. Professor George van Biesbroeck, at Yerkes Observatory, finds that it changes its brightness suddenly, and early this year it had one peculiar outburst which changed its brightness a hundredfold within a few days.

Never is this comet seen with naked eyes. At its brightest it is only twelfth magnitude, which means that only powerful telescopes can catch it. This Schwassmann-Wachmann comet is also probably the first comet that is observable all the way around its orbit.

Although the comet was first discovered in 1927, it has been given the designation of 1925 II (Roman numeral two) in astronomical literature. This is because it was nearest the sun in 1925 and it was the second comet of that year to pass perihelion.

RADIATION FROM VITAMINS

Two of the vitamins, A and B, apparently give off some kind of a radiation that will affect the emulsion on a photographic plate in the same way that light and X-rays do. This is indicated by experiments performed by Sophie Botcharsky, of London, and Anna Foeringer, of Paris.

In the British scientific journal, *Nature*, they report as follows: "Photographic plates were covered with aluminum foil and letters were cut out of the foil covering the glass side. Extracts of vitamins A and B, biologically tested, were used to paint the letters VA and

VB on the glass side. The vitamin A used was ether extract of dried ox-liver, the solvent being removed in nitrogen. Vitamin B was water extract of purified brewers' yeast. The plates, wrapped in black paper, were left for three days; on development, clear images of the letters were obtained.

"To confirm the results, vitamins A and B were sealed in two separate glass tubes, and the experiment was repeated. Very sharp images were again obtained.

"An extract of vitamin A prepared in a Paris research laboratory was investigated in the same way. It also gave positive results.

"Vitamins destroyed but not carbonized did not affect the plates.

"Two solutions, one ten times stronger than the other, of vitamin A in paraffin oil and vitamin B in water, were compared. The plates showed clearly difference in strength. Control experiments of pure solvents gave unfogged plates.

"It is interesting to note that the effect of vitamin B is similar to that of vitamin A, although the two vitamins are of different origin.

"The experiments were repeated several times, and the same definite effect was present. We are proceeding with our research into these effects."

ELECTRICITY FROM THE TIDES

AN experimental power plant which generates electricity continuously from the ebb and flow of the tides has been constructed and successfully operated at the Avonmouth Docks, in the Bristol Channel.

The plant is the invention of Paul Shishkoff, formerly a Russian subject. It includes a novel method of storing the excess power produced at low tide so that a continuous supply of energy can be obtained at all times. The capacity of the installation is three hundred horsepower.

The sea fills up the dock at high tide. As the tide recedes, water from the high level is run through a pipe to drive a water wheel of standard type. The vertical shaft of this wheel is connected to an alternating current generator which produces electric power.

The difference in water level between the inside and outside of the dock varies from seven feet at high tide to 32 feet at low tide, and when this working head of water is at its greatest more power is produced than the generator can take care of.

At these times a water brake on the shaft with the driving wheel is used to store the excess power. This brake really churns water and thus heats it. The water, heated to 390 degrees Fahrenheit, enters a large vessel called an "accumulator," where it is kept under 200 pounds per square inch pressure until the direct power supply from the water wheel falls off.

The superheated water from the accumulator is now released under reduced pressure to form steam. Heat necessary to produce vaporization is derived from the remaining water, which is slightly reduced in temperature.

This steam drives a turbine connected to a generator. Thus power is available even when the low-tide level can not be used directly. The exhaust steam from the turbine is condensed and returned to the brake where it is again heated at times of maximum power.

The pumping of water to a higher level by means of excess power is the only other practicable means of storing power. Apart from the use of this new scheme in connection with the tides, it is of great interest in that it provides possible answer to the important engineering problem of storage.

Mr. Shishkoff has proposed that a larger model of his system be constructed in the Severn River. An artificial basin of 12½ square miles is planned to make available enough water for generating 160,000 kilowatts at peak load. This development, it is claimed, would not interfere with the tidal flow or with navigation in the Severn.

It is claimed that electricity at forty-four hundredths of a cent per kilowatt-hour could be made by such an installation, which compares favorably with a coal-burning plant of the same capacity.

A rival scheme designed by a Swiss engineer, Huguenin, would require the building of a large dam and would use two-way flow turbines. It is still in the theoretical stage.

The Bay of Fundy, Nova Scotia, has a difference in tide level of 35 feet. A large power scheme for this site involving the building of a big dam has been worked out in considerable detail. A similar project for Aberwrack, near Brest, France, has been approved by the French Government and is in process of construction.

DENTAL DISEASE CONTROLLED BY DIET

DENTAL caries, a disease in which the teeth decay and cavities form, can be controlled by suitable diet, it appears from the report to the American Dental Association of Dr. R. W. Bunting, Dr. Philip Jay and Dr. Dorothy Hard, of the University of Michigan School of Dentistry.

These investigators carried on an experiment in caries control for one year in three large groups of children in public schools and orphanages. The children were given a varied diet, fortified by one quart of milk and some green vegetables and fruit for each child every day. They were not given either cod liver oil or viosterol. They had no sugar on cereals or in beverages, very little sweetened preserves and pastries, and little or no candy.

"The elimination of sugar was made on the assumption that the average child consumes more carbohydrate in this form than is required and that such over-consumption of sugar perverts the appetite for other necessary food factors, thus unbalancing the diet." In addition to the diet, a mouth wash of hexylresorcinol diluted with three parts of water was used daily.

At the beginning of the experiment, the teeth were carefully examined and their condition recorded, with actual drawings of the approximate size and location of all cavities and fillings. At the end of the year, the children were examined again in the same manner, and the results of the two examinations compared.

In three groups in which fairly adequate diets were

provided, active caries were almost negligible and old cavities were quite uniformly arrested. In two groups in which the diets were not carefully planned, the dental disease was very rapid and active in its course. Further similar studies are planned.

THE INFORMATION OF KINDERGARTEN CHILDREN

A HOT political campaign may get grown-ups terribly excited, but it leaves no impression on children of kindergarten age. When the question "Who is Herbert Hoover?" was put to 100 youngsters between five and six years old, not one could answer. Only one knew who Al Smith is. Yet 87 knew what Lindgergh did and Andy Gump was familiar to 74.

These questions were asked in the course of an investigation conducted by Cathryn A. Probst, at the Institute of Child Welfare of the University of Minnesota to find out how much information, and what kind, is the equipment of the child when he enters the first grade of the public school. The results of her study are published in the current issue of *Child Development*.

Despite the rarity of the horse, every one of the children knew that this animal has four legs. The only other questions which no one missed were "What do we use to cut cloth?" "What do you use to cut meat?" and "What do you use a saw for?" Among the other easy questions were those dealing with the seasons of the year, the functions of the dentist and barber, the colors of the flag, and a few of the simplest natural history questions.

Some of the errors were amusing. According to some of the children, a carpenter fixes carpet sweepers; buttermilk is made by butterflies; baking powder is used by ladies on their faces; a plumber pulls out plums, and a man who raises corn or wheat is called a bachelor.

It was rather surprising that only 11 knew what Cinderella's coach was made of, and only 9 knew how many wings a butterfly has.

The occupation of the parents made a great difference in the range of information of the children. On only 7 out of the total of 132 questions did the children of semi-skilled and unskilled laborers excel the children of the more trained occupational groups. These questions included "How many eggs in half a dozen?" "What time is it at noon?" "Who is Dempsey?" "How many horns has a cow?" "How many wings has a butterfly?" "What must you not do in tin-tin? (a game)" and "What must you have to play anty-over?"

Boys were better than girls on all types of questions except those dealing with weather and other natural phenomena.

ITEMS

M. ROSENBLOOM, of the Faculty of Sciences of the University of Paris, has found that the particles from some radioactive atoms like radium consist of distinct groups of equal speeds, the speeds of the groups, however, being different. This gives a means of finding out the structure of the small core of the atom, which is the present goal of atomic physical research. The most typical mode of disintegration of radium and other radioactive bodies is by the expulsion of alpha particles with great velocity and energy. These are helium atom cores. It has long been known that from a given element the helium particles appear to be expelled with the same characteristic speed. This indicates that the alpha particle occupies a certain definite energy level in the atom which is defined by so-called quantum conditions. In the radioactive thorium-C atom, which has now been found to consist of a number of distinct groups each characterized by a certain speed, Lord Rutherford has pointed out, these groups disclose the existence of several energy levels within the nucleus. Ordinary electromagnets are not able to cause sufficient deflection but with the assistance of the magnet Professor Aimé A. Cotton, at the Sorbonne, can bend the alpha particles round in a semi-circle and separate them out.

AN electric lamp converting current into light completely without producing heat at the same time has been operated in a laboratory experiment by Dr. M. Pirani, director of the Society for the Study of Electric Lighting in Berlin. The new tube is not suitable, however, for domestic or industrial lighting. The invention of a "cold light" that would avoid wasting 80 to 90 per cent. of the current as heat, as in the ordinary lamp, has been the goal of physicists and engineers for years. Dr. Pirani's new light, however, is actually heated by a furnace on the outside. The tube is a modification of the gas discharge tubes used by neon lights in advertising and recently brought to a 30 per cent. efficiency by Dr. Pirani. He now finds that if the losses due to the higher temperature of the discharge tube are taken care of by a separate source of energy, that 370 lumens or light units can be obtained per watt of electricity. This represents a completely heatless conversion of electricity into light energy.

COMMON ordinary soapsuds, particularly hot ones, are extremely good agents for killing germs, Dr. John E. Walker, of Opelika, Alabama, has reported to the recent meeting at Chicago of the American Medical Association. The results of his own and other investigations show that the germs of pneumonia, meningitis, diphtheria, syphilis, gonorrhea, influenza and the streptococcus germ were all killed in about two minutes by comparatively weak solutions of soap in cool water. The soapsuds compared favorably with many newly-synthesized chemicals in germ-killing power. The brand of soap apparently made no difference, brown laundry soap, floating white soap, perfumed toilet soap, coconut oil and olive oil soaps and soap made according to the standards of the U. S. Pharmacopoeia were equally effective. "When properly used for cleaning the hands or for washing out eating utensils, soaps are undoubtedly potent factors in preventing the spread of diseases due to these organisms." However, the germ of typhoid fever and the staphylococcus organisms are not destroyed by soaps.