SCIENCE NEWS

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ENERGY WITHIN ATOMS

ATOMS seem to have within their hard and heavy central cores a large variety of energy stages, two Rice Institute investigators have discovered after taking over 20,000 photographs in atom-smashing experiments. In the laboratory of Professor L. M. Mott-Smith and Dr. T. W. Bonner atoms were made to shoot off neutrons. From the way these neutrons collided with neighboring gas atoms it appears as if the core, or nucleus, of an atom may be likened to a fortress firing projectiles at the enemy.

The observers found that all the atomic projectiles did not strike with the same energy. Some were powerful as if from 16-inch guns; others were more like rifle fire. Within the atom, it is believed, the different strengths of the "guns" correspond to the different states of energy which drive off the atom particles.

Important to science is the discovery, for instance, that the light and comparatively rare element beryllium has within its nuclear core 20 or more different steps of energy, 20 different atomic "guns" of varying caliber. Scientists have been thinking of energy within the atom as having only a few levels.

To make the atoms shoot off the various particles and so make possible some estimate of the energy forces producing them, Professor Mott-Smith and Dr. Bonner bombarded targets of calcium fluoride, boron and beryllium with alpha particles, or helium nuclei, like those given off by radium. When they did this the atoms of the target liberated non-electrical particles called neutrons. These neutrons shoot off into a chamber filled with gas atoms where they could collide with the gas atoms present. This impact was the "battlefront" on which the scientists watched to learn the atomic secrets.

Through the quartz window in their apparatus, called a Wilson cloud chamber after its inventor, Professor C. T. R. Wilson of England, the collisions of the neutrons and the gas atoms were photographed. As the neutrons hit the gas atoms they drove out little bundles of light that physicists call photons. The range of the photon tracks is a measure of the neutrons' energy; and in turn, a measure of the energy forces within the atoms of the target.

Some 21,000 atomic "battlefront" pictures were obtained, report the Rice Institute scientists. Nine thousand snapshots were made when the calcium fluoride target was giving off the neutrons, 4,000 were taken with boron as the target, and 8,000 more when beryllium was used.

In no case were the neutrons given off in constant energy groups. The range of the recoil light packets—the photons—fell, instead, into different groups. Some would bounce back a certain distance; others would travel farther before stopping. The range observed is a measure of the neutron "bullets" just as the penetration of a real bullet into a block of wood is a measure of its energy.

Analyzing thousands of photographs, it was found that in fluorine there were five different groups of neutrons emitted. The more energetic was equivalent to 2,500,000 electron volts energy.

For boron eight groups of neutron energies were found. The strongest was equal to 4,160,000 volts energy. For beryllium there were over 20 groups and the maximum energy detected was 11,700,000 volts. The experiments of Drs. Mott-Smith and Bonner are published in the *Physical Review*.

NEUTRONS FROM ARTIFICIALLY RADIOACTIVE ELEMENTS

NEUTRONS have hitherto been produced only by the bombardment of atoms, and have ceased to be emitted when the bombardment stopped. Now comes the announcement from the Paris Academy of Sciences that Irene Curie, F. Joliot, and P. Preiswerk have observed neutrons to be given off bombarded phosphorus for as much as three hours after the bombardment had ceased. The spontaneous emission of neutrons is a new form of radioactivity.

The discovery was not made by accident. The investigators had been bombarding various elements with helium cores (alpha particles), and with neutrons. In the case of phosphorus they found that the artificial radioactivity produced was of two sorts. One had a half life of two minutes forty-five seconds, as had already been discovered by Dr. E. Fermi of Rome. The other had a half life of over three hours.

In studying the possible reactions that might give rise to these radiations the scientists found that one of these possible reactions should result in the emission of neutrons. Accordingly they set up the special apparatus required for the detection of neutrons, and found that neutrons were in fact emitted.

In this process they believe that two unstable atoms are produced. One of them is aluminum with an atomic weight 28. Ordinary aluminum has an atomic weight 27. The other atom is silicon with an atomic weight 31. Ordinary silicon is of weight 28, 29, or 30. Both of these top-heavy atoms disintegrate, according to the reactions worked out by the experimenters, with the production of neutrons.

DISINTEGRATION OF ATOMS OF HEAVY HYDROGEN

GAMMA rays, the same kind of radiation used medically for the treatment of cancer, are now being employed to produce artificial disintegration of atoms of the "heavy" hydrogen isotope, deuterium. The atom breakup achieved throws new light on the composition of the newly discovered "heavyweight" hydrogen. Professor James Chadwick and Dr. M. Goldhaber of the University of Cambridge report to *Nature* that by bombarding diplons (deuterium atoms which have lost an electron and become ionized) with gamma rays having energies of 2,620,000 volts they have produced ordinary lightweight hydrogen and neutrons.

Diplons are known in America as deutons. They are favored there as particles with which to bombard other substances and so create disintegration. As ionized atoms of deuterium, diplons have twice the weight of ordinary hydrogen. Drs. Chadwick and Goldhaber indicate that to break down the diplons into their two constituent parts the bombarding gamma rays must have energies greater than the forces which normally hold the particles together. This condition is satisfied with gamma rays of 2,620,000 electron-volts energy.

The new discovery is expected to make possible more accurate estimates of how much a neutron weighs, a point on which various investigators differ at the present time.

A neutron, it will be recalled, is thought by some to be a composite particle consisting of an extremely close union of particles with positive and negative charges so tightly bound that there is no measurable external electric field. It weighs as much as a hydrogen atom but is much more tiny, and hence more penetrating when it strikes some other substance. So piercing is a neutron that it is difficult to distinguish between it and packets of radiation called photons.

THE ROCKSLIDE OF NIAGARA FALLS

NIAGARA has again created a nation-wide sensation by staging a rock-slide on Monday, August 13. Doubtless it will arouse all over again the discussion of various projects for "saving" the falls from the fate their natural erosion may bring them, as it did the last time there was a good-sized rock fall, on January 17, 1931. But it's all a very old story to Niagara.

Some time between twenty-five and fifty thousand years ago, when the Ice Age on this continent was just ending and the Great Lakes, as we know them today, were still young, there were five Niagaras instead of only one. The remains of these great falls have been found by geologists at a point quite remote from their single surviving sister. They thundered for centuries, with no human ear to hear them, in the region where Syracuse now stands. They were left high and dry when the level of the upper great lakes fell, and all the outlet-water was concentrated in a single river, the modern Niagara. When the modern falls first started running they were about seven miles down-river from their present position. They have been backing up ever since, so that the recent rock fall is only a trifling incident in the whole history of the carving of the Niagara gorge.

The existence of Niagara Falls depends on the presence of a sheet of hard limestone overlying a thick bed of less resistant sandstones and shale. The churning water at the bottom of the falls, filled with broken fragments of hard rock, carves away the softer material from under the over-hanging edge whence the waters leap. From time to time pieces of the limestone break off. Usually they are small; the slide of August 13, and the one that occurred three years ago were exceptions. Thus the falls keep young by constantly peeling off bits of their face.

The history of the falls has been the same throughout their millennia of life up to the present. There will come a time, however, when there will be no more Niagara as we know it to-day, but a tumultuous series of cataracts dashing through tumbled gigantic blocks of stone.

This is because the capstone which forms the river-bed at Niagara dips slightly toward the south. Several miles upstream it disappears under a stratum of softer rock, which is not capable of forming a resistant rimrock for the river to jump from. When the river finally backs up to this place, it will scour down through the soft stuff until it finds the limestone, break this up in great pieces and thereafter flow foaming and spouting through the obstacles it will thus pile up for itself.

SPECTRUM MEASUREMENTS OF VITAMIN E AND BIOLOGICAL ACTIVITY

THE long-held hope that the fertility vitamin E would absorb light in a distinct, characteristic fashion and thus make possible a positive identification appears to have been achieved by workers at the Dunn Nutritional Laboratory of the University of Cambridge, Drs. A. J. P. Martin, T. Moore, Marion Schmidt and F. P. Bowden, who describe in *Nature* experiments on the spectrum analysis of vitamin E.

Spectrum analysis is the method in which light after passing through a slit is bent, either by a prism of glass or by a ruled grating, so that its different wavelengths or colors are separated into a rainbow-like image of the original slit. Every substance in nature, it is found, has its spectrum lines at particular positions. Thus elements like hydrogen, iron, etc., or the various combinations of elements that make up compounds can be identified by something akin to fingerprints in man. By dissolving vitamin E, prepared from wheat germ seeds, in alcohol it was found that a sharp absorption occurred at the wavelength 2900 Angstroms when they shone light through it. This wavelength is in the invisible ultraviolet region right near the actinic rays of light which produce sunburn.

The key test in the research was to show that the vitamin E which produced this characteristic absorption really produced a biological effect when given to experimental animals. Such an effect was found, say the investigators, "for the vitamin caused a female rat which had shown characteristic resorption gestation to produce a litter of eight live young."

ALPHA CELLULOSE FROM ASPEN TREES

Two years of chemical research by investigators at the University of Minnesota have resulted in the perfection of a process for obtaining alpha cellulose, a cotton-like substance used in cellophane, rayon and lacquers, from the aspen tree, also known as the "popple" or poplar, which abounds in the cutover lands of northern Minnesota.

"Our laboratory experiments indicate that this product can be obtained from the aspen at a cost that will compare with prices now prevailing on the commercial market," Professor L. H. Reyerson, director of the Northwest Research Institute, stated in announcing this new development. "Our next step is to set up a small commercial plant, turning out perhaps 500 pounds of alpha cellulose a day, where we can determine accurately the cost of production."

The potential value of this development is appreciated when it is realized that alpha cellulose is a major raw

material of many large chemical companies, and yet only two large concerns are to-day supplying it to the market. At present, some 300 million pounds annually are required to meet commercial needs in the United States alone, and research is constantly developing new uses for it. One cord of aspen produces 1,600 pounds of alpha cellulose. There is enough marketable aspen in Minnesota to supply the nation's need for more than 25 years. The current market price is about 5 cents a pound, making this marketable aspen worth $400,000,000.

The alpha cellulose turned out by this process has a purity comparable to the best now on the market, Dr. Reyerson claims. The process also makes it possible to control the viscosity of the product. Thus alpha cellulose with high viscosity could be produced for use as rayon, while it could be made with low viscosity for use in lacquers. At present, the chemical companies must process the alpha cellulose themselves to obtain the desired qualities.

Dr. R. E. Montonna, of the School of Chemistry, has been in charge of the research work on aspen, with Dr. L. Wallace Cornell doing much of the active work. Assisting them have been Dr. R. A. Gorbner, Henry Schmitz, chief of the forestry division, and Samuel I. Aronovsky.

CHARTS FOR AVIATORS

To guide speeding airplanes for 12,000 miles over Europe and Asia, a complete chart of the course of the Macrobertson International Air Race, to take place between England and Australia this fall, has been published by the U. S. Hydrographic Office of the Navy Department. In being the first to print special maps of not only the course but the 25 airports along it, the Hydrographic Office reflects the same interest in the race which has caused U. S. aviators to make the longest list of entries. A map of the path over which 64 planes will fly on or about October 20 appears on the reverse side of the August "Pilot Chart of the Upper Air." In addition a booklet has been published giving a complete list of landing fields and topographical features.

The route, over which it has been estimated the winner will have to achieve average speeds of from 225 to 250 miles per hour, extends from London, over central Europe and Turkey, to Baghdad. From there it crosses Persia to Allahabad, near Calcutta. The airway then passes intermittently over sea and tropical jungle as it skirts the Malay States, Sumatra, Borneo, and part of the Indian Ocean before it reaches northern Australia. The last lap stretches for 2,170 miles over mountains and barren desert until Melbourne, on the southeastern extremity of the continent, looms in sight.

Pilots of 13 countries will compete for prizes amounting to $75,000 in U. S. money. Of the 64 planes slated to take off from Hatfield Airport near London, 29 will bear the brand, "Made in U. S. A." Seven of these are to be flown by pilots representing foreign nations. Numbered among the competitors are four American women who will compete for the $2,500 gold cup and additional $50,000 prize money. The Irish Hospitals' Trust is sponsoring the race. The prizes are offered by Sir MacPherson Macrobertson, millionaire chocolate-candy manufacturer of Melbourne.

The Hydrographic Office maps are to be distributed in England by the Standard Oil Company of New York.

ITEMS

Two unusual meteor photographs were captured at the University of Toronto's Dunlap Observatory by Dr. P. M. Millman during observations of the Perseid meteor shower. They are rainbows or spectra taken with special red sensitive plates. It is expected that they will give new information about the composition of the meteors.

SUGGESTIONS that the neutral atomic building block—the neutron—may consist of a central negatively charged core and positively charged electron, have been made by Dr. Schuler and Dr. Th. Schmidt, of the Astrophysical Institute of Potsdam. Since the usual view of a neutron's make-up is that it consists of a positively-charged nucleus—a proton—plus a negatively charged electron, the new reverse picture would make the neutron an "inside-out" particle.

DR. W. W. PERRETT, Moravian missionary stationed at Hopedale, Labrador, has been keeping a log of radio reception on his set since 1925 and finds that the height of the ocean tide indicates times of good and bad reception, especially fading. The ocean tides, of course, are caused by, and follow, the position of the moon. Despite the fact that Dr. Perrett is very near the "home" of the Aurora Borealis, or Northern Lights, this phenomenon does not markedly influence radio reception at his station. The correlation between tides and radio was described by Dr. Perrett in a communication to E. F. McDonald, Jr., president of the Zenith Radio Corporation of Chicago. In finding that the moon exerts a positive effect on radio, Dr. Perrett is confirming results already obtained by Professor Harlan T. Stetson, astronomer at Perkins Observatory, and Dr. G. W. Kenrick and G. W. Pickard.

VENUS, the planet perpetually enshrouded in a fog-like atmosphere, has great quantities of carbon dioxide in the air above it. Investigation by Drs. Walter S. Adams and Theodore Dunham, Jr., of the Mt. Wilson Observatory, demonstrated the existence of carbon dioxide on Venus in 1932, but an estimate of the quantity present was virtually impossible because it was not known how much the gas absorbed light passing through it. Dr. Arthur Adel, of the University of Michigan, reports in a letter to the *Physical Review* that he has succeeded in obtaining the same carbon dioxide absorption bands in the laboratory as the Mt. Wilson astronomers found in the light from Venus. Dr. Adel's measurements make it possible to form an estimate of the quantity of carbon dioxide present in the planet. "In the upper strata alone," he says, "Venus possesses 10,000 times as much carbon dioxide as is present in the entire atmosphere of the earth."