THE ATOM SMASHERS SCORE A HIT

The most massive substance known is uranium, a white metal which finds its chief industrial use in coloring glass. It is rarer than gold, and is famous as the element in which the French physicist Becquerel discovered radioactivity in 1896, leading to the finding of radium by the Curies two years later.

Another historic discovery involving uranium was hit upon a few weeks ago. Today it is the talk of physical laboratories all over the world. Physicists speak of it with something of the awe and excitement with which their fathers greeted the news of radioactivity and of radium forty years ago.

The new discovery was made by Otto Hahn and F. Strassmann at the Kaiser Wilhelm Institute of Chemistry in Berlin-Dahlem. They were bombarding various elements, using as their minute projectiles neutrons, those mysterious particles which, although supposedly electrical in nature, yet have no electrical charge. Bombardment has long been a favorite preoccupation with atomic physicists, and ever since neutrons were discovered seven years ago experimenters in Europe and America have been firing them at atoms of hydrogen, oxygen, iron, and other elements. Sometimes the neutron smashed head on into the massive center or nucleus of one of these atoms, knocking out an electron, or a proton, or an alpha particle, or perhaps another neutron. Such performances have been going on for several years, and have been called atom-smashing.

But, compared with the German discovery, these former performances may be described as mere atom-chipping. Hahn and Strassmann turned their neutron artillery upon uranium. It weighs 238; the neutron projectile, only 1. Others before this had bombarded uranium with neutrons; but Hahn and Strassmann used slow neutrons, passing their bombarding beam first through an absorbent screen which reduced the speed to about 1½ miles a second. When one of these slow-moving projectiles struck a uranium atom, something extraordinarily violent happened. The overloaded, overstrained, overexcited atom simply split. It divided into two equal or nearly equal fragments, each of which shot off at velocities of hundreds of miles a second.

At first Hahn and Strassmann were unable to explain the occurrence. The fragments appear in the guise of other chemical elements of lighter weight than uranium, and the two unwitting discoverers thought that there was some contamination of foreign substances in their apparatus. They communicated their findings to two colleagues abroad, Dr. Lise Meitner at the University of Stockholm and Dr. R. Frisch at the University of Copenhagen, and it was Meitner and Frisch who suggested that an authentic atom splitting had occurred. A joint report was prepared and published, in which Hahn and Strassmann described the experiments and Meitner interpreted the result. Dr. Meitner, who is generally regarded as the leading woman physicist of the world, was formerly for many years a co-worker with Dr. Hahn, but in 1938 she was compelled to leave Germany both on racial grounds and because there is an additional Nazi prejudice against women as laboratory workers.

The two fragments created by the splitting instantly move off, each with an energy of 100,000,000 volts. Thus a slow neutron, carrying an energy of only a thirtieth of a volt, sets off the enormous energy of 200,000,000 volts. This seeming paradox is explained by the picture of the massive atomic nucleus as a system in equilibrium, with the internal forces of positive electricity tending to burst it apart and the forces of surface tension just balancing. The impact of the slow neutron, slight though it be, is sufficient to set up ripples of disturbance in this delicately balanced equilibrium; and the final result is that the big nucleus, like a quivering drop of water, cleaves in two. The process has been called a "fission," and biologists will immediately be reminded of their long familiar use of this term in the fission of the living cell in growth.

Very promptly after the original discovery, confirmation of it was obtained at Niels Bohr's Institute of Theoretical Physics, Copenhagen, and at the Paris laboratory where Frederic Joliot is pursuing his studies of atomic phenomena. American groups at once took up the experiments - among them Lawrence's laboratory at Berkeley; Fermi, Dunning, and other associates at Columbia; Fowler at Johns Hopkins; Tuve and his associates at Washington.

Several of the individual scientists concerned have received Foundation aid or training, and four of the laboratories mentioned are at present receiving support; but these facts are not the sole reason for the inclusion of this particular story here. The Foundation's present program in the Natural Sciences places its primary emphasis on experimental biology, but the officers make every effort to keep in touch with

important work in other fields. Their record, in this instance, is better than they can hope usually to maintain. The discovery became known on January 31. In his diary for that day, Mr. W. E. Tisdale, the Associate Director for the Natural Sciences in Paris, records that Joliot, in great excitement, called him on the phone to inform him concerning their success, that day, in breaking the uranium atom into fragments. He was just sending off a note to a scientific journal, but said he was so excited that he wanted the Foundation officers to have the news at once. On the same day, Mr. Warren Weaver, the Director for the Natural Sciences, nearly 6,000 miles away from his Paris colleague, was visiting Lawrence in the Radiation Laboratory at Berkeley, California. On the morning of that day the telegraphic news of the discovery reached Berkeley. By mid-afternoon the Foundation officer was privileged to see a confirming repetition of this dramatic experiment.

The American experimenters who confirmed the original discovery have made, in addition, a startling discovery of their own. They observed that as the atom of uranium breaks, one or two neutrons are released. It is conceivable that if one of these released neutrons should encounter another uranium atom, it would bring about a fission similar to the first, with the corresponding release of 200,000,000 volts. If the initial fission occurred inside a mass of uranium, it might start a chain reaction like that of a series of dynamite sticks in a row, each atomic explosion setting off another, and multiplying the original release of 200,000,000 volts many millions of times. It hasn't happened anywhere yet - but some physicists are feeling pretty sober about the possibility. If it ever did happen, it might make an exciting headline for the newspapers of some other planet.