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Leo Szilard

Science Service March 16, 1939

URANIUM ATOMS, SPLIT BY NEUTRONS WITH ENORMOUS RELEASE OF ATOMIC ENERGY, ALSO GIVE OFF OTHER PARTICLES WHICH MAY HELP PERPETUATE THE REACTION

LONDON -- French scientists have confirmed the American discovery that splitting uranium atoms, releasing their enormous amount of atomic energy, also give off neutrons in the reaction.

This liberation of neutrons from uranium atoms split by impact with other neutrons, is most important because it provides a mechanism which, at least theoretically, might serve to keep the chain of splitting continuing and hence produce a continuous release of atomic energy.

Scientists F. Joliot, H. von Halban, Jr., and L. Kowarski report from Paris the discovery in the current issue of the British scientific journal, Nature.

Prof. Joliot and his co-workers find that neutrons (neutral atomic particles) from a source of radium and beryllium can split uranium atoms placed nearby. Along with the energy released additional neutrons are given off in the process. This discovery is comparable with, and a confirmation of, the announcement (Science Service February 24, 1939) that scientists at the Carnegie Institution of Washington's Department of Terrestrial Magnetism had been able to observe the same important reaction in atomic transmutation.

(FURTHER DETAILS FOLLOW) These American scientists, Drs. Richard B. Roberts, R. C. Meyer and P. Wang, found that the secondary neutron emission from the uranium splitting was delayed by some seconds. There is no indication whether the new French experiments also describe a delayed effect or whether the emission of the neutron happened immediately.

Also the American workers would like to know if the experiment really was done with the neutrons obtained from radium-beryllium sources which have energies of 480,000 electron volts, or whether these 480,000 electron volt neutrons were slowed down with large paraffin blocks, then allowed to strike the uranium and split it.

Uranium splitting with these "slow" neutrons is nothing startling now, for it has been done in many laboratories in the few short weeks since the initial discovery. Splitting with 480,000 electron volt neutrons is something else, however. At Carnegie Institution such neutrons were tried but no evidence was found of uranium splitting for these energies.

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EDITORS: So carefully has iron been kept out of a new non-magnetic British research ship, that crew members may not carry pen knives, wear metal buttons or use steel paper clips. Arts -- such as caulking with oakum and tar -- that are but rarely practiced were revived to construct the R.R.S. "Research." A story on this new sailing ship built for science leads the Science Page for March 27-April 2, mailed today. Seven illustrations and 12 stories round out the page.

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Science Service March 23, 1939

TWO MORE ELEMENTS IDENTIFIED CHEMICALLY IN SPLITTING OF URANIUM ATOM

BERLIN -- Two more elements -- xenon and strontium -- have been identified chemically as the products of the splitting of uranium in atom smashing experiments, it is reported by Prof. Otto Hahn and Dr. Fritz Strassmann at the Kaiser Wilhelm Institute for Chemistry at Berlin-Dahlem.

It was Prof. Hahn's discovery that the bombardment of uranium with neutrons would not only split the uranium into fragments but also that tremendous amounts of atomic energy would be released in the splitting. Energies of over 100,000,000 electron volts have been already reported experimentally.

Prof. Hahn's new discovery, announced in the German technical journal, Die Naturwissenschaften, brings to six the number of chemical elements which have now been identified in the uranium splitting under bombardment. These elements are: barium, lanthanum, strontium, yttrium, xenon and caesium.

As the fragments of the exploding uranium atom are further identified chemically, it becomes apparent that there are no set rules for the production of uranium's fission products. It seems only necessary that the fragments should have atomic weights which add up to the atomic weight of uranium 238 plus a neutron of mass one, or a total of 239.

(FURTHER DETAILS FOLLOW) In a simple picture the two splitter fragments might each have approximately half the atomic weight of the unstable form of uranium having mass 239. This would be a chemical element of atomic weight 119 and the nearest thing to this number is the element tin. Actually this element, obtained by a true 50-50 splitting, has not yet been found.

Barium, atomic weight 137.9, was the first one identified and its complementary element (to bring the total mass to 239) is the inert gas krypton.

How relatively light elements like strontium, atomic weight 87, and yttrium, atomic weight 88.9, can appear is a bit puzzling, but can be explained by picturing the splitting of uranium into three fragments instead of two.

A combination of three such fragments that would have an additive mass of 239 would be two strontium atoms each of mass 87 and a zinc atom of atomic mass 65. Strontium has already been identified, but zinc is yet undetected.

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EDITORS: Man's most fascinating creations -- robots -- can now have a synthetic voice, if their makers so wish. It is the Voder. Your readers will want to read all about the Mechanical Men of 1939, and the Voder, in the lead story on the Science Page for April 3-9, mailed today. Nine illustrations and 16 stories round it out.

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NEWS REPORT

from

SCIENCE SERVICE

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SCIENCE PARADE by WATSON DAVIS, Director, Science Service

This time last year this suggestion would have been laughed out of the laboratory ... but the splitting of the uranium atom with promising release of energy ... makes it much more serious. In the present world race for military readiness extraordinary quantities of cheap energy would be priceless ... defensively and offensively. Practical atomic power promises this ... but we do not know enough to achieve it ... if we ever shall. Hint to GHQ of armed forces: Enlist ... quietly and unofficially if necessary ... the brains of those working with giant atom smashers on the atomic nucleus. No rank or active duty or that sort of thing ... that might hamper research ... but see to it they lack nothing ... either materials or extra hands or incentive. It is a good gamble ... Germany may already be taking it on a large scale.

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Medical notes: Carry a person with an injured spine face down whether on a stretcher or without one. Carbon monoxide poisoning occurs much more frequently than all the other forms of poisoning combined. Injection of picrotoxin is being used in the treatment of barbiturate poisoning (sodium amytal, barbital, etc.) Night

rians over 50

FUTURE RELEASE: Friday, Aug. 11 Science Service Aug. 8, 1939

NEW WAY TO SEPARATE ISOTOPES; SEARCH FOR ELUSIVE NEUTRINO PARTICLE; URANIUM SPLITTING REPORTED TO AMERICAN PHYSICISTS

NEW YORK, Aug. 10 -- A new way of separating isotopes quickly and effectively is suggested by Prof. J.W. Beams and Dr. C. Skarstrom of the University of Virginia in the Physical Review published here today.

The new method would combine the whirling properties of high speed centrifuges with the chemical fractionating column method employed by Prof. Harold C. Urey, Columbia University Nobelist.

Isotopes are the forms of chemical elements which have chemical properties so similar that ordinary chemical methods will not separate them. Yet they have slightly different atomic weights.

Separating isotopes is one of the major tasks of physicists these days for isotopes can be employed as "tracers" in studying the physiological happenings of the human and animal body and have already contributed much to knowledge of hitherto obscure body processes.

To operate the new method would require a huge centrifuge, weighing tons, for the columns used at Columbia by Prof. Urey are two stories high. An apparatus to whirl them around in a super-centrifuge would be very large.

SEARCH FOR NEUTRINO

In the same issue of the Physical Review, Drs. H.R. Crane and J. Halpern of the University of Michigan describe their latest search for the elusive and never-found atomic particle, the neutrino, which is believed to have the mass of an electron, without electrical charge.

By bombarding chlorine with deuteron particles from the huge Michigan cyclotron, the scientists have made it emit electrons, or beta rays. Studying the pictures of these beta rays in a Wilson cloud chamber has shown that the ordinary, every-day laws of classical momentum are not conserved unless one assumes that another particle (the neutrino) is liberated in the process.

Because of the neutrino's neutral character actual pictures of its tracks have not been obtained, and probably they will never be found. But the scientists have relationships showing definite directions in space in which the change of momentum occurs. This they interpret as the line of direction of the neutrino.

URANIUM SPLITTING ALSO DESCRIBED

The new attacks on the secrets of uranium splitting -- potential source of atomic power if scientists can ever find out how to create it efficiently and then control it after they have it -- are also described.

Nobelist Prof. Enrico Fermi and Drs. H.L. Anderson and Leo Szilard, of Columbia University, report that by bombarding uranium with slow neutrons they obtain a 20% gain in the number of neutrons emitted. This is evidence -- slight but probably real -- that the splitting of uranium, with its enormous release of atomic power, is probably accompanied by a chain reaction that creates more neutrons to produce more uranium fissions, and so on. The whole question of atomic power is still in the balance for the experiments have yet to give a conclusive answer. The Columbia results are more conservative than reports which have come from French scientists studying this same matter.

Another new finding in uranium's splitting is the study by Drs. J.C. Mouzon and R.D. Park of Duke University on the delayed emission of piercing gamma rays from uranium excited by neutrons. Taking Wilson Cloud chamber photographs of the bombardment, the Duke scientists obtained, out of a great number, one highly interesting picture which may be the first evidence yet found of a multiple fission of uranium.

Previously it has been shown that uranium can be split into two parts by neutron bombardment. The new Duke pictures may reveal a splitting into three or more different products instead of the usual two. More work will be needed to clear this important point.

FUTURE RELEASE: Friday afternoon, Aug. 25 Science Service Aug. 23, 1939

ANOTHER NEW HEAVY ELEMENT FOUND TO SHOW FISSION UNDER BOMBARDMENT OF NEUTRONS; PROTACTINIUM YIELDS TO ATOM SPLITTING

NEW YORK, Aug. 25 -- Rare protactinium has now joined heavy uranium and thorium on the list of elements that undergo splitting into two parts under the bombardment with neutrons.

The huge cyclotron at Columbia University here made possible the new discovery, Prof. John R. Dunning and Dr. E.T. Booth of Columbia University and Dr. A. von Grosse of the University of Chicago announce in the Physical Review today.

Protactinium has atomic number 91, midway between uranium No. 92 and thorium No. 90. Its atomic weight is 231.

Dr. von Grosse was among the first scientists in the world to isolate protactinium and made available the small specimen that served as the target for the neutrons shot out by the cyclotron.

Chemical separation of the "splitter" products of protactinium's fission show that rubidium and caesium are created. At the same time enormous amounts of atomic energy are released of the order of 200,000,000 electron volts and about the same order of magnitude as the energy released in the fission of uranium and thorium.

The splitting of protactinium can only be accomplished with "fast" neutrons. In this the new discovery is similar to the findings already known for thorium's fission. In contrast uranium can be split by very weak "slow" neutrons.

(FURTHER DETAILS FOLLOW) One hope that lies, little mentioned, in scientific reports on atom splitting and the releasing of atomic energy is that by this process atomic power might somehow be made available in a useful form.

It does not appear that protactinium can serve as a "fuel" -- even potentially -- for such use. Releasing atomic power is possible on an economical, hypothetical basis only if each splitting can somehow set off a similar fission in nearby atoms and the whole matter perpetuated by a "chain reaction." For uranium, where weakly energetic neutrons appear to have the power to do this splitting, the idea of "power" from atoms is not beyond the realm of possibility. With protactinium, however, the need for fast neutrons to do the splitting probably means that a chain reaction would not be set up and that power (in any real economical sense) would not be forthcoming.