

PHYSICS

Exploding Uranium Atoms May Set Off Others in Chain

Explanation Suggested at Physics Meeting Believed By Prof. Fermi To Be One of Several Possibilities

EXPLODING atoms of uranium may set each other off in a chain like sticks of dynamite laid in a row. New possibilities exist that such explosive ruptures, with release of enormous amounts of atomic energy, may have hidden in their action a method of perpetuating themselves in a chain, or cascade effect, it was disclosed at the meeting of the American Physical Society.

It has been found that the splitting of uranium by neutrons also produces another neutron which, potentially, could have the power to disrupt a neighboring uranium atom and thus make a continuous cycle of atom destruction and bring about a continuing release of atomic energy after the initial "trigger" action.

This new work was described informally and at an unscheduled gathering of experts in atom-smashing. Prof. Niels Bohr and Prof. Enrico Fermi, both Nobel prize winners, were among the eminent men who were present at this meeting in which the new discovery of scientists at Carnegie Institution's Department of Terrestrial Magnetism was discussed.

The discovery at the Carnegie Institution of Washington is known as a delayed neutron emission. After uranium is bombarded with neutrons and split into two parts, with a great release of energy, it has now been found that the split parts go on giving off neutrons with a reaction having a half life of about 12 seconds. So new is the work that no estimates have as yet been made of the efficiency of the process. However, it is probably very small.

Despite speculation that such an event might set off a catastrophic chain of events that would end in the complete destruction of the uranium sample, scientists believe that such imagined events have little probability of occurring. The delayed neutrons created, they believe, will go out at random from uranium atoms, and few of them would strike uranium atoms to keep the chain of atomic splitting alive. Only rarely would one of the delayed neutrons happen to

hit another uranium atom and break it, too.

Prior work on uranium splitting has indicated that for a single neutron striking a single uranium atom the process was very efficient. But it was also found that it needed enormous expenditures of energy to create a single neutron. It has been estimated that in over-all efficiency the process is only six per cent. for the most favorable cases, and it is probably ordinarily much less.

The newest work, however, raises the possibility that the delayed neutrons created in the uranium splitting may split other uranium atoms nearby, so that the single primary neutron touches off the train of atomic splitting.

In an interview Prof. Fermi admitted that the possibility of such a chain action was certainly present in any theoretical discussion of the new discovery but he added that it was only one of several other possibilities less dramatic and equally likely.

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Sun Is "Youngster"

THE sun is a youngster and the brilliant, dense white dwarf star Sirius B is a "grandfather" among the stellar bodies, it appears from the report by Dr. R. E. Marshak and Prof. Hans A. Bethe of Cornell University.

Sirius B is the relatively tiny star whose diameter is only 20,000 miles. Yet it is as massive as the sun, whose diameter is about 1,000,000 miles. Sirius B is 20,000 times as dense as the sun.

The dense, dwarf star consists of a gaseous envelope whose density is only slightly larger than that of the sun and a very dense core. The boundary temperature (between the envelope and the core) of Sirius B has been calculated at 8,000,000 degrees Centigrade, the Cornell scientists explained. Previous calculations suggested that this boundary temperature was as high as 60,000,000 degrees.

Dr. Marshak and Prof. Bethe, in new calculations, find that there can be only

a very small amount of hydrogen present in Sirius B. It is the gas hydrogen which is now believed to be the "fuel" which most stars burn to create their enormous outpourings of radiation.

At the high temperatures and densities of Sirius B the radiation would be enormous if the dwarf star contained as much hydrogen as the sun. Therefore it is concluded that Sirius B contains less than one-thousandth of one per cent. of hydrogen.

In the case of Sirius B it seems that the star has reached a stage wherein the high temperature and observed brilliance is caused mainly by gravitational contraction of the star.

A conclusion from this new work is that stars rich in hydrogen, like the sun, are young stars, while stars low in hydrogen content, like the white dwarf Sirius B, are the oldsters of the stellar bodies.

Science News Letter, March 11, 1939

WPA Scientist on Einstein

A YOUNG mathematical physicist now working on a WPA project at Massachusetts Institute of Technology has announced modifications of Einstein's general theory of relativity which may make it possible to apply this basic theory to the problems of atomic nuclei.

The man is Dr. Nathan Rosen who for two and a half years worked with Prof. Einstein at the Institute for Advanced Study at Princeton, N. J., and who is now at M.I.T. assisting Prof. G. R. Harrison in preparing new tables listing spectroscopic wavelengths for all the known elements.

Being a mathematical scientist, Dr. Rosen carries his "workshop" around in his head and needs only pencil and paper to devise new theories. In his spare time, in the last few months, he has been exploring the possibility of adapting the general theory of relativity—which works so well for large scale bodies—to meet the problems encountered in studies of the nuclei, or hearts, of atoms.

In his report to the American Physical Society, Dr. Rosen explained that the framework of general relativity theory is uniquely determined by arbitrarily set "laws." To adapt the theory to the nucleus, it is necessary to introduce a change into the basic framework of relativity.

This change consists of not only working mathematically with a Reimannian, or curved, space, as does present relativity theory, but also adding mathematical

symbols common to Euclidean, or flat, space.

Out of his intricate mathematics Dr. Rosen has been able to devise formulae which appear to make gravitation a factor in nuclear problems, something which previously has not appeared in theories about the hearts of atoms.

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Mapping Skin Pores

A NEW method of mapping the pore pattern of the human skin, which may some day supplement present fingerprinting methods in establishing human identity, was described by Dr. Harold A. Abramson, New York physician specializing in biophysics.

When methylene blue is applied to the skin by electrical current the whole area soon turns blue. But if the surface of the skin is rubbed thoroughly, all the color comes off except at the places where pores of the sweat glands show. Thus tiny blue dots show up under a microscope at any places where sweat glands are present, virtually over the entire body.

A significant point, although Dr. Abramson did not describe it to the physicists and mentioned only the physics of the phenomenon, is that the patterns of the sweat glands are characteristically different for every individual in the same way that fingerprints are characteristically unique. In fact, a close examination of fingerprints shows that along each ridge are pores and that the fingerprints are merely the readily visible patterns of the pores in a particular spot on the body.

Explaining the phenomenon, Dr. Abramson pointed out that electrical currents can carry drugs and dyes into the skin by a process known as electrophoresis. Using dyes like methylene blue, it has now been learned that it is through the pores of the sweat glands that this passage occurs. Previously scientists did not know whether it was the hair follicles, the skin as a whole or the pores which transmitted the materials electrically.

Drugs like cocaine, novocaine and histamine have long been known to have the ability to penetrate the skin without breaking the skin by injection.

The new method of making the pore pattern show up on any part of the body will give scientists new "maps" for every individual that are much more comprehensive than present fingerprints. Human identification in accidents where fingerprints may be obliterated is only one possible application.

Another drug which Dr. Abramson has been able to make penetrate into the body through the skin by electrical action is sodium prontosil, a drug with many of the beneficial aspects of sulfanilamide. Whether the new method will be used in the treatment of infectious diseases for which sodium prontosil is helpful has not yet been studied, but the possibility exists.

Science News Letter, March 11, 1939

Compact X-Ray Machine

MASSACHUSETTS Institute of Technology scientists have constructed a 1,250,000-volt electrostatic X-ray generator so compact it fits in a small tank three feet in diameter and nine feet high, Prof. John G. Trump reported.

Only one-tenth the size of its million-volt predecessor, built in 1937 for the Huntington Memorial Cancer Hospital in Boston, the new generator will go into the tumor clinic of Massachusetts General Hospital.

A new mercury bath method of directing the piercing, 1,000,000-volt X-rays of another powerful machine, to be installed this spring in the new quarters of the Memorial Hospital, New York, important American center for cancer treatment, was also described to the meeting by Dr. G. Failla, Memorial Hospital physicist.

Small hollow boxes are sunk in a bath of mercury and will serve as exit slits for the powerful X-ray beams, to give

angular control of the radiation to radiate hidden tumors within the body of a patient. The heavy mercury around the boxes stops the radiation, which goes through the boxes easily.

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Water Wall Cuts Off Heat

WALLS of cooling water instead of glass are the newest feat of scientists in using extremely hot electric arcs in their laboratories.

Making transparent, gas-tight enclosures in the form of cylindrical "curtains" of water was reported to the meeting by Dr. Brian O'Brien of the University of Rochester's Institute of Optics.

"If a continuous film of liquid is projected from a long narrow slot, the film will, in general, collapse a short distance beyond the orifice due to surface tension," said Dr. O'Brien's report.

"This can be prevented by a suitable component of the emerging liquid. Such films in the forms of figures of revolution are useful as transparent gas-tight enclosures about high intensity light sources, the liquid serving as a light filter."

A powerful 10 kilowatt carbon arc light has been operated many hours inside a water film, shaped like a cylinder nearly four inches in diameter and a foot long without a break occurring in the film.

Larger cylindrical films, a foot across and two feet long, have been produced.

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PSYCHOLOGY

Psychologists Devise Game To Teach "Mindreading"

NEW card games that teach the players "telepathy" have been developed by psychologists and will soon be put on the market by Dr. Ogden Reed, experimental psychologist, of Chicago.

The object of the game is to learn to read the thoughts of another person as he concentrates on one of the cards pulled from a shuffled deck. The prize for the best score is contained in a sealed envelope included with the game. This surprise consists of an explanation of how the "mind reading" is done.

Here is the secret for one of the games. This test is called "What time is it?" The cards each contain the face of a clock with the hands pointing to either 3, 6, 9, or 12.

Experiments conducted by the psychologists have shown that nine out of ten people look first at the center of the clock dial and then move the eyes to the figure at which the hand is pointing. By observing the eyes of the person concentrating on the card, it is easy to name the hour indicated on the card.

The game not only demonstrates the importance of such unconscious facial expressions in so-called mind reading, but also provides a means of developing powers of observation, Dr. Reed commented. After playing the game 20 to 30 times, the average person should be able to name almost every card correctly, he said.

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