

## PHYSICS

# Italian Discovery May Be First of Super-Elements

**No. 93, Reported by Fermi, May Be Unstable Element Thought Impossible Only a Few Years Ago**

**H**AS a super-uranium, the first of a series of elements heavier than the recognized 92 chemical building blocks, been discovered?

Scientists are wondering as a result of the report that Dr. Enrico Fermi, brilliant 32-year-old physicist of Rome's Royal University, by atomic bombardment has created artificially a new element, No. 93. He bombarded uranium, heaviest of elements, with the non-electrical particles known as neutrons.

Element No. 93 makes a bid for recognition as the result of this year's fast-moving development in knowledge of the atom's interior which began with the discovery of artificial radioactivity.

Uranium is the heaviest element found in nature, being 238 times as dense as hydrogen, the lightest. For many years it was thought to be the limit of all the possible elements but recently Sir Arthur Eddington and other theoretical scientists have calculated the maximum number of possible elements as 136. Element No. 93 of Dr. Fermi, if its reality is substantiated by competent investigators working independently, may be the first of the super-heavy substances lying beyond uranium in the gamut of chemical elements.

Opinion among American physicists regarding Dr. Fermi's discovery indicates that if still heavier elements are found they will be transitory substances breaking down like the naturally radioactive elements such as radium but probably much faster. For the provisional element No. 93 it is reported to take only  $13\frac{1}{2}$  minutes for the initial quantity of the element to "decay," or disintegrate, to half the amount.

## Differs From Earlier Research

On what proof Dr. Fermi bases his report on the actuality of element No. 93 is still unannounced. In his recent communication to the British scientific journal, *Nature*, however, he cites twenty-three cases where he had been able to produce artificial radioactivity in a variety of elements with the same ap-

paratus he employed for creating element No. 93. In recounting his work Dr. Fermi told of observing negative charges of electricity—electrons—being giving off as the man-made radioactive substances decayed away. Thus he differed with the earlier research of Irene Curie and Prof. F. Joliot of Paris who have observed particles of positive electricity—positrons—being omitted in the process.

The atomic happenings which might account for the creation of the new element out of uranium are still a subject of debate and conjecture among scientists. One possible occurrence might be that the neutrons used by Dr. Fermi (consisting, if they do, of a positive particle, the proton, and a negative charge, the electron) might break into two parts on impact with the nuclei of the uranium atoms. The proton might embed itself within the uranium nucleus and so increase the weight of the atom to No. 93 while the electron part of the neutron would be given off in the process and be detectable either with electrical instruments known as Geiger counters or by photographing the electron tracks in a Wilson cloud chamber.

## Not Verified With Spectrograph

The best way to determine whether the new element No. 93 really exists would be to weigh it on the atomic "scales"—the mass spectrograph. It does not appear that this crucial test has been applied in Dr. Fermi's work for no mention was made of the method.

What amazes American scientists regarding Dr. Fermi's experiments is that his source of bombarding neutrons is comparatively weak. In a small glass tube the Italian scientist placed beryllium and the radioactive gas, radon, given off by radium as it breaks up. The action of the radon on the beryllium caused swift-moving neutrons to come off which struck a nearby bit of uranium. About 100,000 neutrons were liberated in this (*Turn to Next Page*)



Courtesy Eustache de Lorey, Paris.

## ADORED BY THE HITTITES

*A rare figure of a goddess of the Hittites—or so she is believed to be—shows us in person the sort of divinity that so distressed Hebrew prophets of the Bible. Once worshipped by adoring eyes, the goddess is now gazed at critically by visitors in the Worcester Art Museum, where she is an important "loan" from Paris.*

## ARCHAEOLOGY

## Hittite Goddess Shows No Classic Beauty

**A** PLAIN little figure is a goddess who has sailed across the seas to show Americans the sort of divinity worshipped by the Hittites, 1400 B. C.

The sculptor who made her thought arms and legs unimportant. He merely sketched in a suggestion of a robe or dress. But he gave careful attention to a coiffure, with hair parted in the middle and rolling down ending in long locks on either side of the head. Around the neck, bands placed high and low, resemble the curls in technique, but may be ornaments. The staring hollow eyes probably shone with jewels, once, but even bejeweled the goddess has little of the alluring charm that our imaginations might conjure up when we think of the heathen gods of the Bible lands.

Not so long ago, the Hittites were thought of vaguely as one of the enemies of the Children of Israel, named in the Bible. They are now known as important people of northern Syria and Asia Minor.

*Science News Letter, June 16, 1934*

fashion each second. In America sources of neutrons have been developed which are capable of giving off 100 times this number per second.

It is only since the beginning of 1934 that the technique of creating artificial radioactivity in normally stable elements has been known to the world of science. On January 31 Irene Curie (daughter of Madame Curie, discoverer of radium) and her husband, F. Joliot, announced that by bombarding the elements boron, magnesium and aluminum with the heavy cores of helium atoms they were able to create transitory radioactive forms of nitrogen, silicon and phosphorus.

Substantiation of the Curie-Joliot experiments followed swiftly from the Cavendish Laboratory at the University of Cambridge, England, and from the California Institute of Technology and the University of California. In England the favorite atomic bombarding particles have been the cores of hydrogen atoms—the protons. In the California experiments the cores of the

new heavy hydrogen—the deuterons—have been driven at a variety of elements to produce artificial radioactivity.

Work prior to that of Dr. Fermi on the creation of artificial radioactivity has all been accomplished by using relatively light-weight elements as targets. That the same phenomena could be produced in the heaviest and most complicated atom of all, uranium, was unknown. For uranium, and the whole series of elemental offspring which finally ends when lead is reached, it was known that natural radioactivity was occurring, with the elements gradually turning into substances of slightly less weight. Many experiments seemed to indicate that nothing man could do would change the rate at which the natural disintegration occurred, either to slow it down or speed it up. If Dr. Fermi's work on the creation of element No. 93 is substantiated later by other scientists it will be the first case where the sequence of natural radioactivity change has been altered.

*Science News Letter, June 16, 1934*

#### PHYSICS

## Transmutation May Yet Be Put to Practical Uses

By DR. R. M. LANGER, Physicist,  
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**I**F THE process of making heavier radio-active elements out of lighter ones, reported discovered by Prof. Enrico Fermi in Italy, can be made efficient enough it may lead to a practical method of creating useful radioactive substances for medical purposes or scientific study.

When neutrons strike the nucleus of a light element they try to make trouble by kicking out an alpha particle or helium atom core. If this proves too difficult they bounce out themselves.

Never in the past have they been found to join the nucleus in peace. Still, physicists have felt that in the stars or wherever else matter is built up many such peaceful unions must take place.

Now the Italian physicist, Fermi, reports he has made neutrons stick to the heaviest element known, namely, uranium, which has almost 238 times the mass of hydrogen, the lightest element. If this proves true a new element will

have been formed heavier than any known heretofore.

The heavy product seems to shake off an electron and this causes it to break the record for highest nuclear charge, namely 93. It may be that one of the lighter forms of uranium is attacked. In this case the mass would be only 235 but the nuclear charge would still be 93.

Apparently this process may be very efficient because the uranium nucleus is so heavy, large and complex that the neutron can fritter away its excess energy within the uranium and then be too exhausted to leave. After a few seconds an electron leaves instead and then the fun begins. For the new element is radioactive and keeps changing by sending out alpha, beta and gamma rays until lead is formed.

The first problem that the new experiments are likely to solve is the old mystery of the source of the actinium series. Apparently nature has been doing slowly what Prof. Fermi just learned to do rapidly.

*Science News Letter, June 16, 1934*

#### PHOTOGRAPHY

## Largest Precision Camera To Copy Charts

**T**HE WORLD'S largest precision camera, 31 feet long and weighing 14 tons, so big that its operators work inside of it, has just been placed in operation for reproducing nautical charts and airway maps more than 4 feet square.

So precise is the work of this huge camera, which resembles a railway trestle in structure, that cork pads and other vibration-damping provisions must be used to eliminate the slightest building tremors, although it has been installed directly on the foundations of the new Department of Commerce building.

Capt. R. S. Patton, director of the U. S. Coast and Geodetic Survey, states that this gigantic instrument will make it possible to photograph a complete chart on one negative, with a probable error of not more than two-thousandths of an inch. Two years were devoted to its design, construction and adjustment, at a total cost \$15,240. Copyboards weighing a ton slide easily along steel tracks and do not spring the frame more than one hundredth of an inch.

In order to get the greatest accuracy possible every available source of information was consulted from the designs of commercial copying cameras to reports of technical experts at the National Bureau of Standards. The preliminary designs were made at the Sight Shop of the Naval Gun Factory.

*Science News Letter, June 16, 1934*

#### AGRICULTURE

## Mexico Seeks Wheat To Grow in Tropics

**A**N AGRICULTURAL experiment station in the hot lowlands of Guerrero, Mexico, is trying out several kinds of wheat to see if some of them might not be adaptable to the tropics. Mexico lives on corn, a grain biologically less efficient than wheat.

Although the mountain highlands raise wheat, white bread is a luxury to Indians.

Experiments with different varieties of wheat are being made on the high central plateau to improve present production in wheat raising areas. The Japanese soy bean is being tested for Mexican adaptability. Because of its high protein value this bean might serve to supplement the inefficient native diet.

*Science News Letter, June 16, 1934*