PHYSICS

Tapping of the Atom's Energy Achieved in New Experiment

Cosmic Rays Produced Artificially for First Time as Beryllium Core Engulfs Helium Without Disintegrating

COSMIC RAYS, most piercing radiation known to man, have been produced artificially for the first time at the Physical Institute of the University of Giessen by Prof. W. Bothe and Dr. H. Becker. The process gains energy at the expense of the matter in the atom nucleus and thus realizes the old hope of tapping the energy of the atom.

Beryllium metal, bombarded with alpha particles from the radioactive element polonium, was in these experiments made to emit rays as penetrating as 14 million-volt X-rays so far unattained by man. The new rays are so penetrating that after passing through nearly three inches of iron they have lost only a third of their intensity.

Artificial Transmutation

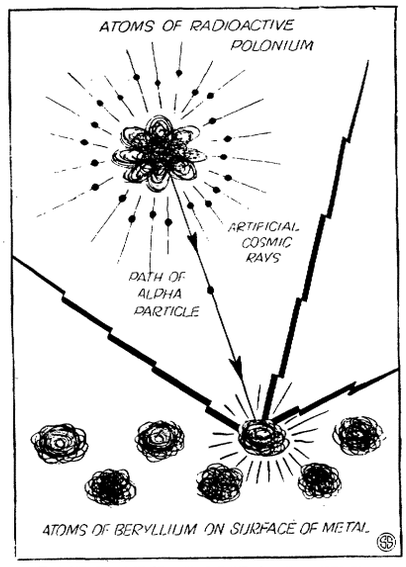
Previous experiments on the bombarding of atoms with alpha particles, which are helium atom nuclei moving at high speed, have resulted in the production of proton rays, the speeding hearts of hydrogen atoms. Artificial transmutation of the target atom nucleus into another chemically different element, had thus been attained by the loss of the hydrogen nucleus.

Drs. Bothe and Becker found, however, that beryllium gave off no protons when bombarded by alpha particles. The alpha particle entered the nucleus of the beryllium atom which at the same time emitted cosmic rays holding much more energy than the impinging alpha-particle projectiles.

Hitherto unknown carbon atoms of atomic weight 13 were thus formed from each of the beryllium atoms hit. This achievement constitutes a new type of transmutation of a chemical element. The process can be represented by an equation similar to those used to picture chemical reactions.

Six of the light chemical elements, Drs. Bothe and Becker found, gave the artificial cosmic or hard gamma rays under the action of the polonium alpha particles. These elements were: lithium, beryllium, boron, fluorine, magnesium and aluminum. Of these, beryllium gave by far the most intense secondary rays and therefore was most suitable for experiments. Some of these elements also emitted proton rays.

Science News Letter, March 12, 1932



POWERFUL BOMBARDMENT

This diagram shows how radioactive polonium sends out showers of speeding alpha particles, of which only one in a great number scores a hit on a beryllium atom and thus sets up a cosmic radiation.

ARCHAEOLOGY

Unearth New Portrait Of King Tut's Girl-Wife

See Front Cover

A NEW portrait of the girl-wife of that well-known Egyptian pharaoh, Tutankhamon, has been unearthed from the ruins of Tel-el-Amarna, where the Egypt Exploration Society has been excavating. The portrait is a beautiful little head, with exquisitely modeled features. It is less than two inches long.

Identity of the portrait has been settled with reasonable certainty by J. D. S. Pendlebury, who directed the excavations. Without hesitation, Mr. Pendlebury pronounced the face to be so closely like that of a woman on the back of a chair in Tutankhamon's tomb, that both must be the same character. The portrait on the chair is that of Tutankhamon's wife.

The little sculptured head bears a startling likeness to the famous beauty Queen Nefertiti, it was also pointed out. This is added proof of the identity of the portrait, for Nefertiti was the mother of the princess who became Tutankhamon's queen.

Science News Letter, March 12, 1932

PHYSICS

German Physicist Interprets Experiments With Cosmic Rays

By Prof. Dr. W. Bothe, of the Physical Institute of the University of Giessen

OUR EXPERIMENTS show that energy is gained if any alpha particle is shot into the beryllium nucleus. That is to say, by addition of an alpha particle to the beryllium nucleus, a carbon nucleus of atomic weight 13 is produced which contains less energy than the two original nuclei together.

These experiments give a hint as to the way in which the building up of the atom nuclei actually takes place in the universe: The heavier nuclei are produced by steps from the lighter. The hypothesis which Dr. Robert A. Millikan has made to explain the "ultra-rays" (cosmic rays), that the heavy nuclei are formed direct by the sudden combination of a great number of protons and electrons is accordingly very improbable.

In still another connection the gamma radiation from beryllium is of interest in connection with the problem of the cosmic rays. The new rays are much harder than the known radioactive gamma rays, their penetrating power approaches close to that of the softest components of the cosmic rays. Thus in the beryllium rays one can study the properties of a gamma radiation which has approximately the

penetrating power of the cosmic rays. As is well known, my earlier experiments with Prof. Werner Kolhorster (reported by Science Service in January, 1930) showed that the properties of the cosmic rays are very different from those of a gamma radiation, and that the cosmic rays behave rather as a corpuscular radiation. Dr. H. Becker and I have now carried out the same experiments with the gamma rays from beryllium; it turns out that these still behave completely like a normal gamma radiation and quite differently from the cosmic rays. This is further strong support for the idea that the cosmic rays have a particle-like nature in the lower layers of the atmosphere.

A series of other light elements, as well as beryllium, can be artificially excited to gamma ray emission. The production of artificial gamma rays is just as general a phenomenon as the breaking up of atomic nuclei. In this radiation we have a means of studying the structure of the lighter atomic nuclei; we are standing at the threshold of a "nuclear spectroscopy." Indeed the light atom nuclei are of special interest.

Science News Letter, March 12, 1932

BIOCHEMISTRY

Scientists Learning Secret of How Plants Manufacture Food

THE CHEMICAL process which scientists consider most essential to life on earth and which so far has eluded the most penetrating and painstaking research is now yielding its secrets to Prof. James B. Conant of Harvard.

Prof. Conant is helping find how plants use sunlight to change the inert gas, carbon dioxide, plus water, into sugars and starches on which they live and grow. The key to his work is a new formula which he suggests for chlorophyll, the complex green substance that is instrumental in converting raw materials into plant food.

He described the formula when he was recently presented the Nichols medal of the New York section of the American Chemical Society in recognition of this work. Scientists have known for some time that each molecule of chlorophyll *a,* one of the two chlorophyll compounds, contains 55 carbon, 72 hydrogen, five oxygen and four nitrogen atoms, and one magnesium atom. Prof. Conant has worked out a formula like a crazy-quilt pattern which shows how these atoms are joined together.

Advances Summarized

Notable advances in the same field of work for which Prof. Conant was given the Nichols medal have been made by German scientists.

"The green coloring material of plants was shown by the German scientist Willstaetter in 1912 to be a mixture of two compounds, chlorophyll *a* and chlorophyll *b*." Prof. Conant said. "These substances absorb sunlight, which thus furnishes energy for the production of sugar and starches from carbon dioxide. Willstaetter showed that the chlorophyll molecule contains magnesium and can be converted by drastic treatment into a series of red compounds known as porphyrins. A similar, but not identical, porphyrin is responsible for the red color of blood. It is protoporphyrin which combined with iron and a protein is hemoglobin, the actual red blood coloring material.

"In the last five years Hans Fischer of the University of Munich has discovered how to synthesize porphyrins and has thus established the structure of the blood porphyrin and the chlorophyll porphyrins. This knowledge is fundamental to an understanding of chlorophyll.

"These porphyrins are compounds with a large ring made up of four smaller pyrrole rings each containing a nitrogen atom. The relation between the green chlorophyll *a* compounds and the red porphyrins, and the nature of certain additional groupings of atoms characteristic of the chlorophyll molecule have been the subject of study at Harvard in the last four years."

Prof. Conant pointed out that the American research has shown that the green series of compounds derived from chlorophyll *a* has as its basis the nucleus of the porphyrin plus two hydrogen atoms. A similar relationship is well known between benzene, or benzol, and the terpenes, such as occur in essential oils. Thus chlorophyll *a* has as its base a reduced porphyrin ring.

PROF. JAMES B. CONANT
—who is attacking one of science's most difficult problems.

Chlorophyll *b* is like chlorophyll *a* except for the fact that one oxygen atom replaces two hydrogen atoms on the ring.

Prof. Conant declared that the final formulae for chlorophyll *a* and *b* must be considered as provisional. But he believes the essential nature of all the atomic groupings in the molecule is understood.

Science News Letter, March 12, 1932

ENTOMOLOGY

Cannibal Grasshoppers Infect Selves with Fungus

GRASSHOPPER species that practise cannibalism on the bodies of their defunct brethren may be unwittingly arranging for their own demise from the same disease. This is indicated by results of an investigation announced in *Science,* by Maurice T. James of the University of Colorado.

Mr. James laid out a number of freshly-killed grasshoppers of a common western species, and found that the bodies were attacked by members of the same species, which bit into the bodies from underneath and ate out the soft contents of the thorax or chest region. He also found that in at least a few cases the grasshoppers also ate the bodies of their comrades that had died of a fungus disease. This suggests a "sure-fire" method by which this disease may be spread in nature.

Science News Letter, March 12, 1932