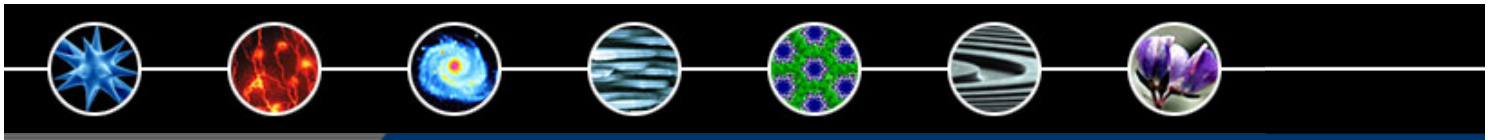

UCSB ScienceLine

Encouraging Curiosity for a Lifetime

How did Ernest Rutherford discover the proton? What was his experiment?

Question Date: 2016-02-03

Answer 1:

Ernest Rutherford bombarded nitrogen atoms with helium nuclei (alpha particles), and hydrogen atoms (protons) were formed as a result. From this, he concluded that nitrogen nuclei contained protons.

Note from ScienceLine moderator:
Please watch this video as the best way to illustrate the Rutherford's experiment for the discovery of the proton.

Answer 2:

Great question! **Rutherford's experiment was incredibly powerful due to its simplicity, use of cheap materials, and the information he uncovered.** Rutherford's main focus was on studying the nucleus through radioactive decay.

After the electron was discovered by Thomson in 1897 and after Rutherford's work on discovering the existence of the nucleus 1911, it was known that there must exist particles of positive charge to balance the negatively charged electrons to create electrically neutral atoms.

The series of experiments, performed by Rutherford and his student James Chadwick, **consisted of changing one element into another by hitting atoms with high energy alpha particles.** Specifically, they noticed that nitrogen, oxygen, and aluminum, when hit with an alpha particle, disintegrated and emitted a fast particle of positive charge. Or said more specifically, hydrogen nuclei were always emitted in the process. In a dark room, they were able to observe flashes of light when alpha particles hit the target. Alpha particles, which were also discovered by Rutherford, are spontaneously emitted by radioactive materials such as uranium. It was realized that the positive charge of any nucleus could be accounted for by a whole (integer) number of positively charged hydrogen nuclei, which were named protons by Rutherford in 1920.

They immediately wondered what was left behind on the target after this process occurred. The conclusion was that the target captured the alpha particle (2+ charge) and emitted a proton (1+ charge), resulting in the target having a nuclear charge different than before. The target was now an isotope of another element. In the case of a nitrogen target, the nitrogen had a nuclear charge of 8 instead of seven, making it an isotope of oxygen **(an isotope is an atom with the same charge but a different atomic weight.)** This describes how the proton itself was discovered.

Many key experiments by Rutherford, his students, and others occurred before this and led to the understanding of the atom that is still the accepted model today.

Answer 3:

Note from ScienceLine Moderator:

A Science Journalist wrote the following information for ScienceLine in order to correct the historical error about the first man-made nuclear transmutation. We thank this person for their time and interest in providing reliable information to our audience.

From a Science Journalist

For nearly 70 years, most scholars have incorrectly attributed the first man-made nuclear transmutation to Rutherford, however, the credit belongs to **Patrick Blackett**, a research fellow working under Rutherford. Between 1921 and 1924, Blackett performed the experiments that identified and proved the transmutation of nitrogen to oxygen. He published his results in 1925.

In 2016, I published a forensic historical examination of the early 20th century transmutation research in my book Lost History. In 2017, I communicated my findings to the U.S. Department of Energy, Office of History and Heritage Resources; the American Institute of Physics, Center for History of Physics; the Imperial College London, Physics Department (Home to Blackett's laboratory); and the Cambridge University, Physics Department (Home to Rutherford's laboratory). Each organization has now completed its own independent analysis, concurred, and corrected their respective Web sites. Here are the respective URLS:

(U.S. Department of Energy)

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