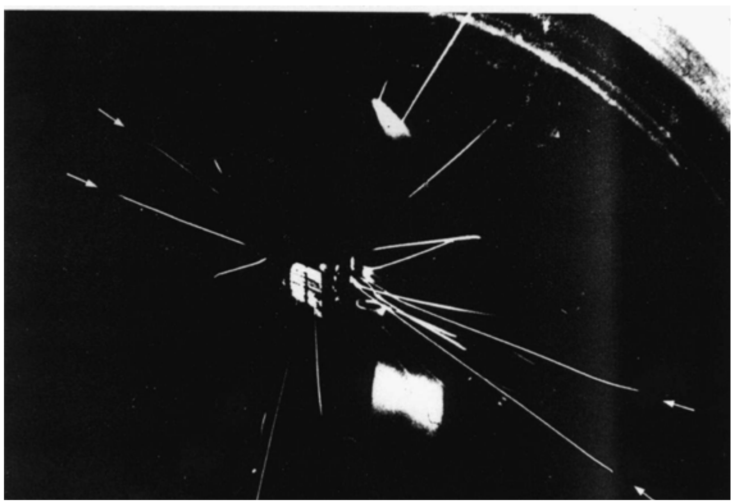
TRANSMUTATION BY CHARGED PARTICLES

Transmutation of lithium by protons.

In 1932, Cockroft and Walton were the first to establish the transmutation of a nucleus by artificially accerelerated ions[1]. Protons accelerated to a few hundred keV were allowed to fall on a lithium target; a large number of fast α particles was observed. The equation of the reaction is:

$$_3Li^7 + {}_1H^1 \longrightarrow {}_2He^4 + {}_2He^4 + Q$$

The reaction energy, Q of this process has a high positive value (17 MeV).



First transmutation of a nucleus by artificially accelerated ions

The two α particles are therefore emitted with an energy of 8.5 MeV in nearly opposite directions. In the picture, two pairs of these α particles can be seen. The end of the accelerating tube is in the centre of the WILSON could chamber. It is separated from the chamber by thin mica windows. The protons hit a thin, inclined lithium target; the α rays may enter the cloud chamber through the mica windows on both sides. On one side, the range of the α particle is somewhat smaller because in this direction the α particles penetrate the lithium target. Single tracks can also be seen, whose partners have been absorbed in the window support.

[1] The advantage of artificially accelerated particles over natural radioactive α sources lies in the much greater numbers of particles available. 1 mg of radium emits 3.7×10^7 α particles per second; a proton current of 1µA, however, corresponds to 6.3×10^{12} particles per second.