An Attempt to Demonstrate the Existence of Short Range Alpha Particles from Radium C.

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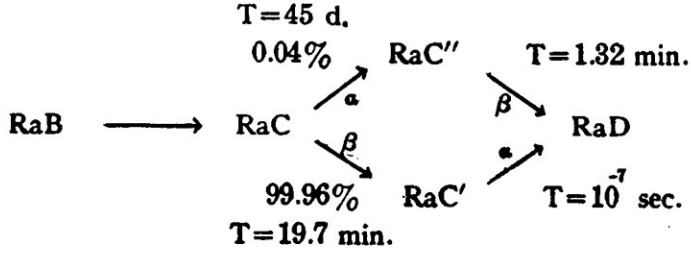
Abstract.

An attempt has been made to detect short range particles from RaC by the Wilson chamber method but no group of particles of definite range could be detected above the general background.

It has long been known that radium C can disintegrate in two ways. The great majority break up emitting a β particle with a half value period of 19.7 minutes giving rise to radium C′, a substance of extremely short life emitting the well known group of α particles of range about 7 cms. About 3 or 4 in 10000 RaC atoms however break up with emission of an α particle giving radium C″ followed by a β ray change leading again to RaD.



Radium C″ was isolated by Hahn and Meitner[1] by recoil and was shown to decay with a period of 1.32 minutes giving out β rays. The emission of α rays from RaC has never been demonstrated experimentally. From the branching ratio it can be surmised that the period of these RaC atoms is about 45 days and from the Geiger-Nuttall relationship their α particle range should be about 3.6 cms.

1. Hahn and Meitner, *Phys. Zeit.*, **10**, 697, (1909). Fajans, *ibid.*, **12**, 369, 378, (1911). **13**, 699, (1912). Albrecht, *Wien Ber.*, **128**, 925, (1929).

To demonstrate the existence of these 3.6 cm. particles, if they exist, is difficult, as they are swamped by the overwhelming number of 7 cm. particles from RaC′. The most promising method seemed to be that of the Wilson chamber. Preliminary calculations showed a reasonable possibility of solving the problem and experiments were made. The attempt however was negative as will be seen.

Method.

The method consisted in photographing large numbers of α particles from a source of the active deposit of radium (which had decayed long enough to eliminate all RaA), measuring up the short tracks and seeing if there existed a group of these particles of definite range. The chief source of error would be RaC′ particles shortened by passing through the edges of the slit system. Accordingly great care was taken with the slit system and also with the purity of the source to reduce the errors to a minimum.

The Wilson chamber was 6 cm. in diameter. The piston was moved by a spring and cam. To avoid contamination the source was separated from the chamber by a mica window of 1.1 cm. air equivalent. The source was a platinum button 1.1 mm. in diameter. After exposure to the emanation it was washed with alcohol and heated in vacuo.

The slits were made of silver foil of 12 cm. stopping power. The first, 0.7 mm. in diameter, was placed directly in front of the mica window. Being smaller than the source it eliminated any effect due to the edge or the side of the source. The second was a slit 1.4 cm. long and 0.5 mm. in width placed on a circular arc 1.2 cm. distant from the mica. A screen on the piston uncovered the slit only during the last millimeter of the stroke.

Pictures were taken on standard cinematographic film, an arc being the illuminant. Only short tracks with well defined ends were counted. A number of tracks with poorly defined ends, probably due to particles coming late in the expansion, were excluded.

Results.

About 6400 tracks were photographed, which was sufficient to show that the effect looked for could not be found. Short tracks were present in much larger numbers than were to be expected. The number of tracks between 3.3 and 6 cm. in length was about 2.1% of the total against a calculated value of less than 0.3% due to edge effects at the slits. The tracks were fairly uniformly distributed in length with no more variations than would be expected from probability variations in the small numbers involved. There was no sign of any definite group. These experiments cannot be said to disprove the existence of the RaC α particles, for the background found was great enough to swamp completely the sought-for group from RaC.

The reason for this excess number of short range tracks is unknown, but the result is in keeping with the general impression gained in counting scintillations in a magnetic spectrum of the rays. It is possible that there may exist a continuous distribution of slower α particles from a radioactive source in addition to the homogeneous group. The proof or disproof of this point would require considerable further experimentation.