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ALPHA RADIOACTIVITY OF $E > 11$ MEV IN NATURE

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En raison de l'urgence de sa publication, cet article a été accepté sous la responsabilité de ses auteurs.

Résumé. — Des particules alpha d'énergie supérieure à celles connues jusqu'à présent ont été observées dans des minéraux naturels en utilisant les techniques de comptage électronique et d'émulsion nucléaire.

Abstract. — Alpha particles with energies greater than those so far reported to occur in nature have been observed in minerals by emulsion and counting techniques.

1. **Introduction.** — Much work over the past few years has been devoted to the search for superheavy elements in laboratories throughout the world. If Gentry's recent article [1] reporting evidence for several new elements in nature has been widely criticized, we feel that the question of the existence of superheavy elements in nature remains open. If they do exist, they would offer a possible explanation for such phenomena, among others, as giant halos [2] and long (1) and short [4] range α-particles. In one approach to the problem, we took as a starting point the research for *anomalous* α-radioactivities, principally in uranium-thorium containing minerals [3] (Monazites from Madagascar).

For the present study, electronic counting and nuclear emulsion techniques have been applied. By both methods, α-particles with energies greater than those thus far recognized to occur in nature [5, 6] have been observed.

2. **Experimental methods and results.** — The detection of highly energetic α-particles is rather straight forward, since for $E_\alpha > 10.5$ MeV, there is no interference from polonium isotopes. In the counting of thick samples with silicon surface barrier detectors, an energy cut-off to randomly occurring events was observed at approximately 16 MeV. In one case, over a period of 40 days, for $12 \leqslant E_\alpha \leqslant 16.5$ MeV, 13 events were accumulated. The background, deduced from simultaneous counting of an artificial sample of similar chemical composition, was 1 event. The effect was reproducible. The detector thicknesses were such that an energy deposition of 16 MeV had to come from a particle at least as massive as a helium nucleus, and the possibility that the counts were due to protons is thus excluded.

In complementary work, the exploration of a limited surface of impregnated nuclear emulsion has revealed tracks of 74, 83 and 84 μm. Verification of granulation and range-energy curves [7] made with thorium stars served to identify these tracks as being due to α-particles of $E = 11.5$ and 12.5 MeV. The maximum uncertainty, as deduced from the extreme values measured for 100 tracks of given thorium decays, is estimated as 0.5 MeV. These three tracks showed no branching. Another simple track possibly corresponding to an α-particle of approximately 15 MeV was also seen, but it showed an anomaly in its trajectory.

3. **Conclusion.** — Two independent methods have demonstrated the existence of α-particles with energies greater than 11 MeV in nature. Their existence can explain the origin of giant halos, whose radii correspond to α-particles of energies up to approximately 15 MeV, in a manner consistent with the explanation invoked for the smaller radioactive halos [2, 8]. There could also be a connection to naturally occurring superheavy elements, the details of which remain to be elucidated.

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(1) ADER, M., Private communication.

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