

LETTERS TO THE EDITOR

THE STUDY OF SHORT-LIVED ALPHA EMITTERS ^{157}Lu AND ^{153}Tm ON
"IRIS" FACILITY

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(Received April 24, 1979)

On the IRIS facility in Gatchina the investigations of alpha decay of the short lived rare earth nuclei have been started. The isobare $A = 157$ has been studied by the on-line isotope separator technique. For the isotope ^{157}Lu the alpha energy 4.995 MeV, $T_{1/2} = 5.5 \pm 0.3$ s, and for ^{153}Tm alpha branching ratio 0.80 ± 0.10 has been determined.

In the collaboration of the Leningrad Nuclear Physics Institute in Gatchina and Joint Institute for Nuclear Research in Dubna, the facility for the investigation of nuclei far from the beta stability line has been put in operation. The facility is based on the LNPI synchrocyclotron and the IRIS [1] mass separator working on-line with the 1 GeV proton beam. The combined target-surface ionization ion source system of the mass separator has been developed in Dubna [2].

In the present paper we would like to present the experimental result concerning the

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alpha decay of ^{157}Lu as a part of a complex investigation of the alpha decay of short-lived nuclei above the closed neutron shell $N = 82$ [3].

In our experiment the mass separated products of the spallation reactions on tantalum were collected on the aluminium catcher of the rotating collector. The collection time, the transport of the catcher in front of the surface barrier alpha detector (FWHM ≈ 23 keV), the counting sequences and spectra storage in the EC 1030 computer were controlled by the small on-line computer M-400 [3].

A strong evidence for the suggested earlier ^{157}Lu alpha decay [4, 5] studying the mass $A = 157$ has been obtained, due to the relatively high yield of lutetium. Nuclides have been identified analysing their decay curves and alpha energies.

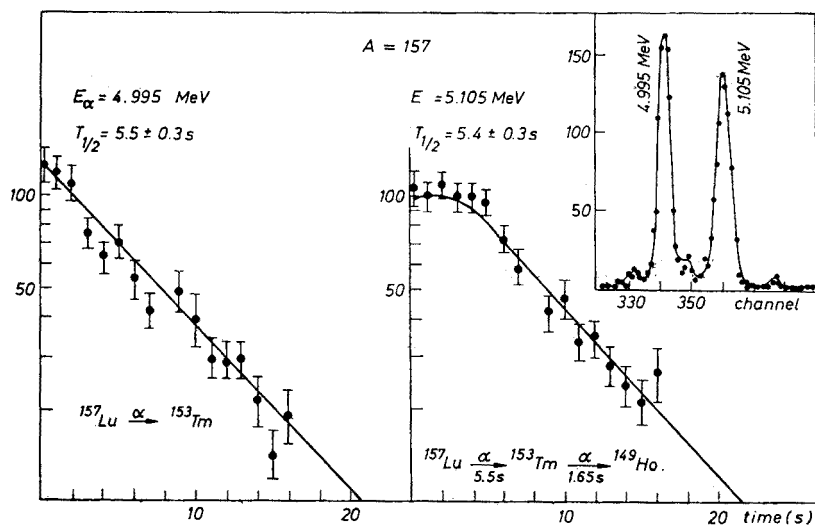


Fig. 1 The part of the alpha spectrum for $A = 157$, and decay curves for alpha lines $E_\alpha = 4.995$ MeV and $E_\alpha = 5.105$ MeV

The existence of the well known 5.105 MeV alpha line from ^{153}Tm on the 157 isobare with the initial growth and then the $T_{1/2} \approx 5.4$ s decay — characteristic for the daughter product — give evidence that the 4.995 MeV alpha line having the same $T_{1/2} = 5.5 \pm 0.3$ s belongs to the ^{157}Lu decay (Fig. 1). The energy 4.995 MeV is in good agreement with the systematics of decay energies [6] and the results of Ref. [5].

The relative intensities of alpha lines from ^{157}Lu and ^{153}Tm make it possible to determine the alpha branching ratio for ^{153}Tm as 0.80 ± 0.10 and the relative reduced width $W_\alpha = 0.9$ using the alpha decay formalism developed in [7] and the normalization in which $W_\alpha = 1.0$ for the decay of ^{212}Po . This value is in agreement with the systematics of the reduced widths and the experimental result of [5].

In addition, at the mass number $A = 158$ we have observed an alpha line with $E_\alpha = 4.665 \pm 0.010$ MeV and $T_{1/2} = 10.4 \pm 1.0$ s. This we have assigned to the decay of the new ^{158}Lu isotope. On the basis of the parent-daughter relationship an alpha branching ratio 0.55 for ^{154}Tm has been preliminarily determined.

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