The Decay of $^{143}$Sm to Levels in $^{143}$Pm

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The beta decay of $^{143}$Sm was reinvestigated with the aid of a Ge(Li) detector. Levels of $^{143}$Pm at 271.8, 1,056.5, 1,173.4, 1,403.2, 1,514.9, 1,752.8, 1,816.3, 1,853.6, (2,000), 2,009.0, 2,080.5, 2,344, 2,443, 2,463, 2,906 and (3,054) keV were established. Log $f$ values for all observed beta transitions have been calculated. Spin and parity assignments have been made from electron capture and positron disintegration considerations and gamma branches. The experimental level scheme of $^{143}$Pm is compared with the results of 1 and 3 q.p. calculations for $N=82$ nuclei.

1. Introduction

During the last three years the single closed shell, $N=82$, nuclei have been frequently investigated as well theoretically as experimentally (e.g. Ref. 1-7). The low lying levels of most of the $N=82$ nuclei are now well established, but the situation is much less clear for the higher excited states (above 2 MeV). For this reason we reinvestigated the beta decay of $^{143}$Sm with a 50 cm$^3$ Ge(Li) detector in order to look for the high energy gamma transitions.

During the course of our experiments, Hesse 6 published his results on the decay of $^{143}$Sm and in general there is a good agreement between these results and ours, except at excitation energies above 2 MeV, where some disagreements appear.

2. Experimental Procedure

The target of $^{143}$Sm was produced by irradiating samples of spectpure Sm$_2$O$_3$ (Johnson-Matthey) with a bremsstrahlungsspectrum of the 32 MeV Linac of the University of Ghent. The Sm$_2$O$_3$ samples were

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enclosed in extremely pure (99.999 % Koch-Light) aluminium capsules, and transported from the irradiation site to the detector by a rabbit-system.

The energy of the Linac was chosen at 16 MeV in order to reduce the intensity of the \((\gamma, 2n)\) and \((\gamma, p)\) reaction products. The irradiation time was 10 min. The reactions \(^{27}\text{Al}(n, \gamma)^{28}\text{Al}\), \(^{27}\text{Al}(n, p)^{27}\text{Mg}\) and \(^{27}\text{Al}(n, \alpha)^{24}\text{Na}\) on the capsule could not be avoided, due to neutron background.

The gamma-rays were observed with a 50 cm\(^3\) Ge(Li) detector \((\gamma\text{-tec})\).

The decay period for each gamma-ray was verified in the following way: Starting one minute after the end of irradiation (to allow for the elimination of short-lived activities, mainly 6.7 sec \(^{26}\text{Al}\)), using a routing unit \(^8\), the gamma-ray spectra were stored in two successive intervals (each equal to 10 min) in separate halves of a 4096-channel analyser.

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Fig. 1a and b. The energy region 650 to 3,300 keV of the gamma-ray spectrum in a 50 cm\(^3\) Ge(Li) detector with 7.2 g/cm\(^2\) lead absorber, after bombardment of \(\text{Sm}_2\text{O}_3\) with 16 MeV end-point bremsstrahlung. The numbering of the gamma-lines of the 8.9 min activity of \(^{143}\text{Sm}\) is that of the Table. The notation S.E. and D.E. is adopted for single escape and double escape peak.

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