LIFETIME MEASUREMENTS IN Sb$^{121}$

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ABSTRACT

Employing delayed coincidence techniques lifetime measurements have been carried out in the decay of Te$^{121}$ to decide between two alternative level schemes for Sb$^{121}$. Our results support the scheme proposed by Gupta which consists of excited levels in Sb$^{121}$ at 70 and 576 KeV.

1. INTRODUCTION

The 17-day ground state of Te$^{121}$ is known$^{1,2}$ to decay by electron capture to excited states of Sb$^{121}$, giving rise to electromagnetic transitions of 576, 506 and 70 KeV; the latter two are in coincidence. Excited states of Sb$^{121}$ have been placed at 506 and 576 KeV$^{3}$ as shown in Fig. 1 a.

![Fig. 1. The decay scheme of Te$^{121}$](image)

It was pointed out by Wapstra$^{4}$ from an examination of the systematics of the occurrence of $d_{5/2}$ and $g_{7/2}$ levels in isotopes of Sb and I that there may be a level at 70 KeV in the case of Sb$^{121}$. Recent coincidence studies by Gupta$^{5,6}$ suggest excited states at 70 and 576 KeV, i.e., the 576 KeV level decays by 576 and 506 KeV gamma-rays to the ground state and the 70 KeV excited state respectively, as shown in Fig. 1 b. In addition, a level at 1200 KeV...
populated from the decay of the 154-day isomeric state of Te$^{121}$ was also proposed, the level de-exciting by an 1130 KeV gamma-ray via the 70 KeV level.

It is the object of the present investigation to establish the correct decay scheme by measuring the half-life of the different excited states. If the first decay scheme (Fig. 1 a) is correct, the lifetime of the 576 and 70 KeV transitions must necessarily be the same since they both originate from the same initial state, while the lifetime of the 506 KeV should be different. Alternately, if the second decay scheme (Fig. 1 b) is correct, the lifetime of the 576 and 506 KeV transitions must be the same, while that of the 70 Kev transition might well be measurably longer.

2. SOURCE PREPARATION AND EXPERIMENTAL RESULTS

Natural antimony, consisting of 57 per cent. Sb$^{121}$ and 43 per cent. Sb$^{123}$, was bombarded with 6 MeV protons from the Ohio State University cyclotron. The tellurium isotopes of mass 121 and 123 ground state and isomeric state were produced.

The single gamma-ray spectrum was measured with a cylindrical NaI (Tl) crystal (1 inch diameter, and 2 inch height) optically coupled to an EMI 9536 B photomultiplier by means of silicone grease. A typical observed spectrum is shown in Fig. 2. The gamma-spectra from sources of Ba$^{138}$

![Fig. 2. Single gamma-ray spectrum of Te$^{121}$ source.](image-url)