LETTERS TO THE EDITOR

SEARCH FOR GAMMA-RAYS FOLLOWING THE DECAY OF 3-HOUR Ti^{45}

THE decay of 3·1-hour Ti^{45} has been studied by several investigators.[1] While the transition directly to the ground state of Sc^{45} by electron-capture and positron emission has been well established, the information regarding population of the excited states of Sc^{45} has been somewhat contradictory. The measured[2] spin of the ground state of Sc^{45} is 7/2, and the parity is presumably odd. From the systematics of levels in the region of f 7/2 ground state orbitals, one may expect that a 5/2 level may exist within a few hundred Kev. of the ground state. From the known positron end-point energy,[3] the Q value for the $Ti^{45}Sc^{45}$ ground state decay is 2·02 Mev., hence there is sufficient energy available for positron decay to an excited state or states, up to an excitation of 1 Mev.

There have been some efforts to observe gamma-rays following the Ti^{45} decay.[3,4] The only reported gamma-ray has an energy of 450 Kev.[5] which does not agree with the first excited state energy of 377 Kev. found by Windham *et al.*[6] by inelastic proton scattering experiments. More recently, however, Ishii and Takahashi[7] studied the (γ, n) reaction on natural Titanium and reported a weak gamma-ray of 377 Kev. They concluded that the intensity of the branching to that level was about 0·3% of that of the ground state. A study of the gamma-rays in the decay of Ti^{45} has been undertaken in an effort to resolve the apparent discrepancy. Ti^{45} was produced by bombarding pure Sc^{45} with 6-Mev. protons. The single gamma-ray spectrum observed in a 1" × 2" NaI (Tl) crystal contained only the annihilation radiation. The gamma-spectrum coincident with positrons was investigated next employing two NaI counters at 90° to each other to minimize annihilation radiation coincidences. The coincidence resolving time was 25 nanoseconds. The coincidence spectrum showed the presence of a gamma-ray of 270 ± 10 Kev. Since a 90° scattering of the annihilation radiation can produce such a gamma-ray, a triple coincidence experiment was performed in which gamma-rays in coincidence with the two annihilation quanta were looked for. In the range up to 600 Kev. no gamma-ray was observed. An upper limit of 0·1% (relative to the ground state decay) could be set on any gamma-ray.

The ground state spin of Ti^{45} can be either 3/2, 5/2 or 7/2 with odd parity. An assignment of 7/2 for this and 3/2 for the 377 Kev. level seen in inelastic scattering experiments would explain the absence of any gamma-rays following Ti^{45} decay. The author wishes to thank the hospitality of Prof. P. S. Jastram of Ohio State University where this work was performed.

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