

I. 6 In-Beam γ -Ray and Conversion-Electron Spectroscopy of ^{107}In

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High-spin states in ^{107}In has been studied by Andersson et al.¹⁾ using the $^{92}\text{Mo}(^{19}\text{F}, 2p2n\gamma)^{107}\text{In}$ reaction. In this study, unambiguous spin and parity assignments have not been made for the 1854.1-keV and higher-lying states, and no detailed comparison with theoretical predictions has been made.

We have performed a nuclear structure study of ^{107}In by measuring γ -rays and internal conversion electrons from the $^{106}\text{Cd}(\alpha, p2n\gamma)^{107}\text{In}$ and $^{106}\text{Cd}(^3\text{He}, pn\gamma)^{107}\text{In}$ reactions. The aims of the present study are to construct an improved level scheme of ^{107}In and to test the hole-phonon coupling model for interpretation of the nuclear structure of ^{107}In .

Following previous measurements²⁾ of γ -ray excitation functions, proton- γ coincidences and γ -ray angular distributions, we have measured γ - γ coincidences and internal conversion electrons. Three parameter ($E_{\gamma 1} - E_{\gamma 2} - \Delta t$) γ - γ coincidence measurements were made with two combinations of detectors, i.e. $94\text{ cm}^3\text{ Ge(HP)}-94\text{ cm}^3\text{ Ge(HP)}$ and $94\text{ cm}^3\text{ Ge(HP)}-5\text{ cm}^3\text{ Ge(HP)}$. The time resolution of the coincidence measurements was about 20 ns. Conversion electron spectra were measured with a mini-orange spectrometer.³⁾ The spectrometer was placed at an angle of 125° with respect to beam direction. Transmission curves of the spectrometer were measured with ^{152}Eu and ^{125}Sb standard sources.

K-conversion coefficients α_K for transitions in ^{107}In have been deduced from the relative values of α_K obtained in the present experiment by normalizing the experimental α_K for the M4 transition from the 678-keV $1/2^-$ state to the $9/2^+$ ground state in ^{107}In to the theoretical value given by Hager and Seltzer.⁴⁾ The deduced α_K were compared with theoretical values⁴⁾ for different multipole transitions, and it has been found that all the transitions of which α_K were measured are of M1/E2 character except for the 1429 keV transition, which shows E1 character. These results were used for parity assignments. In Fig. 1 the experimental α_K obtained in the present study are compared with the theoretical predictions.⁴⁾

Figure 2 shows the level schemes constructed from the present experimental data of (a) the $^{106}\text{Cd}(\alpha, p2n)^{107}\text{In}$ reaction and (b) the $^{106}\text{Cd}(^3\text{He}, pn)^{107}\text{In}$ reaction. The levels newly identified in the present study are those at 2416.8, 2431.2, 3314.7, 3742.6 and 3852.4 keV shown in Fig. 1(a) and the 1972.7 keV level in Fig. 1(b). The spin assignments to the levels at energies higher than 1853.4 keV made in Ref. 1) are respectively larger by one unit than the present ones, due to the different multipolarity assignments to the 150.3 keV transition made in the two studies.²⁾ The remainder of the present results is in agreement with

the results reported in Refs. 1) and 5).

We have made a calculation based on the hole-phonon coupling model to reproduce the low-lying states in ^{107}In . In this calculation the ^{108}Sn nucleus was considered as a harmonically vibrating core which couples to the $1g_{9/2}$ proton hole to give the ^{107}In states. We restricted ourselves to quadrupole phonons, and took account of basis states up to three phonon states. The present calculation of the one-phonon multiplet reproduces rather well the excitation energies and spin sequence of the low-lying positive parity states in ^{107}In , and also the branching ratios and mixing ratios of the transitions between these states. A serious defect of the one-phonon multiplet description of ^{107}In is that no candidate for the $7/2^+$ member of this multiplet has been observed. The present calculation of the two-phonon multiplet have failed in reproducing the observed level structure of ^{107}In .

References

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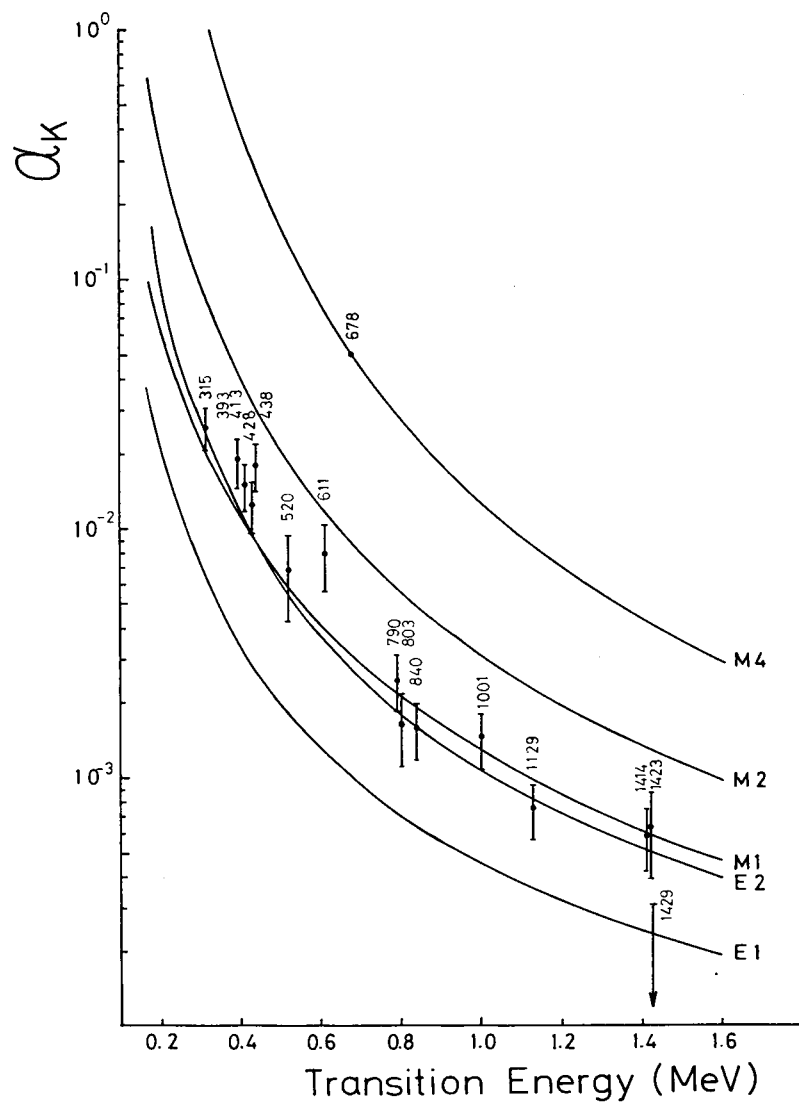


Fig. 1. Experimental K-conversion coefficients for transitions in ^{107}In . Curves are theoretical predictions.

