Penetration effect on internal conversion for the 35.5 keV $M1$ *l*-forbidden transition in ^{125}Te following the EC-decay of ^{125}I

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The probability of the emission of a conversion electron is most often evaluated from the probability of photon emission and the internal conversion coefficient (ICC), α. This assumes that all nuclear structure effects are contained in the γ-ray emission probability and α only depends on atomic properties. In this case the interaction between the conversion electron and the nucleons only takes place outside the nucleus [1]. This picture is valid for most transitions, however, the atomic electron involved in the conversion process may penetrate into the nucleus and will interact with the transition charges and currents in the interior of the nucleus. The corresponding *"dynamic penetration"* matrix element M_e, which is dependent on the nuclear structure and not necessarily proportional to the γ-ray matrix element U_γ (as it was in the case of point-like nucleus), may result in anomalies in the measured ICCs. The penetration effect for magnetic transitions is often described by the penetration parameter $\lambda = M_e/U_\gamma$. The study of penetration effect from the measurement of ICCs provides an opportunity to test nuclear structure models by comparing the calculated λ with experiment. The measurement of λ could also be used to deduce the renormalization of g_s factor that is associated with the spin-force constant. ^{125}I is one of the commonly-used medical isotopes. To carry out low-energy electron measurements is part of our program to improve the knowledge of atomic radiations, including Auger electrons, for medical isotopes [2]. Here we report on our results from the conversion electron measurements. The measurements are essential to determine an accurate absolute yield of Auger electron emission from a radioisotope by the simultaneous measurement of conversion and Auger electrons.

In this talk we will present our high-resolution measurement of the conversion electrons from the decay of the 35.5 keV excited state of ^{125}Te using an electrostatic spectrometer at the ANU. The 35.5 keV transition is known to be a mixed $M1+E2$ transition, dominantly the $M1$ multipolarity. The penetration parameter $\lambda = -1.2(6)$ and mixing ratio $|\delta(E2/M1)|$=0.015(2) were deduced by fitting to the available literature and the present conversion electron data. To interpret our results, we have calculated λ in the framework of particle-vibrational model. The calculated λ is not consistent with the experiment in terms of both sign and magnitude. The disagreement in magnitude stems from the underestimation of the calculated U_γ. By adopting U_γ from the experimental reduced B($M1$) transition rate to the calculations, a reasonable agreement is found between the theoretical and experimental $|\lambda|$. In order to predict the sign, we compared the sign of mixing ratio $\delta(E2/M1)$ from the angular distribution and correlation results in literature with the calculated sign of the $E2$ matrix element. This semi-empirical analysis suggests λ is negative, which is in accord with our experimental results [3].

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