Precise Measurement of α_T for the 39.76-keV *E*3 transition in ^{103}Rh: Further Test of Internal Conversion Theory

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This project was an extension of a series of precision measurements of internal conversion coefficients (ICC) to the 39.76-keV, *E*3 transition in ^{103}Rh. The goal of these measurements is to test the theoretical ICC calculations, with special attention paid to the role of the atomic vacancy caused by the conversion process. Our previous measurements demonstrate that the atomic vacancy must be considered in theoretical calculations, and our aim in this work is to extend the applicability of this statement to Z=45, the lowest atomic number we have yet to measure. A sample of ^{103}Pd was activated by thermal neutrons at the Texas A&M TRIGA reactor for ~5 hours. Decay spectra were then acquired for 22 days, starting 3 weeks after the source activation in our HPGe detector which is precisely efficiency calibrated. We made sure to identify all impurities in our ^{103}Pd sample in order to correct for any contamination that might affect the energy regions of interest to us. The ratio of x-rays to 39.76-keV gamma rays was used to extract the total ICC, α_T, after we carefully corrected our peak areas based on the weak impurities found. Our preliminary result yields α_T(39.76)=1437(44). This value is statistically closer to the theoretical calculation in which the atomic vacancy is considered, α_T(hole)=1404, than the theoretical value that ignores the vacancy, α_T(no hole)= 1389. This is consistent with our previous measurements which demonstrated that the atomic vacancy must be considered in ICC calculations.