Precise Measurement of $\alpha_K$ and $\alpha_T$ for the 39.8-keV E3 $\gamma$ transition into $^{103}$Rh $\beta^-$ decay to Improve the Internal Conversion Theory

Our goal is to distinguish the two versions of the internal conversion theory, one which ignores the atomic vacancy left behind from the emitted electron and another that takes the vacancy into account. Spectra were recorded with an HPGe detector was calibrated to a precise efficiency of about $\pm$0.15% relative uncertainty. In the acquired spectra, the impurities of the $^{103}$Ru source were properly analyzed and amended based on the energy and areas of the $\gamma$-ray peaks using MAESTRO-32 and the Evaluated Nuclear Structure Data File database. The more precise gf3 $\gamma$-ray analysis software further used to get the precise peak areas of the intense transitions of $^{103}$Rh to get the clean areas of the 20.6-keV Rh K x-rays and the 39.8-keV $\gamma$-ray used to extract the experimental value of the . In comparison to the theoretical calculations, our preliminary result, although not in agreement with both theoretical calculations, is much closer to the hole “frozen orbital” limit but in clear disagreement with the “no hole” limit in accordance with the previous results. More experiments are required to further improve upon the internal conversion theory with taking into account the vacancy left by the atomic electron.