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Excitation of ^{93m}Mo secondary beam ions in HIRFL

Nuclear Excitation by Electron Capture (NEEC) was predicted by Goldanskii and Namiot as the inverse process of internal conversion in 1976[1]. It was expected to play an important role in the isomer depletion, which is a potential path for releasing nuclei energy stored in isomer[2].
The first experimental observation on NEEC was reported in the slowing down process of ^{93}Mo[3]. The observed isomer depletion probability was too large to be reproduced by Coulomb excitation, and thus attributed to NEEC. However, it also failed to be reproduced by following theoretical works[4,5]. On the experimental side, a comment was addressed on the influence of complex γ background which may cause the overestimation of isomer depletion probability[6]. Later, an independent experiment was performed using a ^{93m}Mo secondary beam, but no isomer depletion was observed with an accuracy of 2×10^{-5}, which was reported as the upper limit of the excitation probability[7]. However, this measurement was performed with lower recoiling energies than the previous experimental work.
A refined experiment has been performed with higher recoiling energy and purity of the ^{93m}Mo isomer beam. Both lead and carbon foils were used to stop the ^{93m}Mo ions. Isomer depletion is observed, and the excitation probability is about $2 10^{-5}$ *for lead, and* $3 10^{-6}$ for carbon. These results agree well with the calculated probabilities for inelastic reactions, which are suggested to the main mechanisms exciting the ^{93m}Mo isomer during its stopping process.

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Notes

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