ID de résumé : **26**

Probing ^{93m}Mo isomer depletion with an isomer beam in HIRFL

Contenu

As the inverse process of internal conversion, Nuclear Excitation by Electron Capture (NEEC) was predicted to play an important role to trigger the isomer depletion [1], which is a potential path for releasing nuclei energy stored in isomer [2]. Traditionally, NEEC is expected to be observed in two scenarios, plasma and slowing down process of highly-charged ions. However, in both cases, NEEC might be sheltered by other mechanisms, such as Coulomb excitation.
The first experimental observation on NEEC was reported in the slowing down process of ^{93m}Mo [3]. The observed isomer depletion probability was too large to be reproduced by Coulomb excitation, and thus attributed to NEEC. However, a subsequent theoretical work unveiled a dramatic gap between the theoretical and experimental results [4]. Later, another theoretical work was devoted to resolve the disagreement by considering the momentum distribution for bound electron rather than free electron [5]. However, only the upper limit was slightly increased and the discrepancy remained. 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].
To avoid the complex γ background, we produce a ^{93m}Mo secondary beam using the RIBLL in HIRFL to separate the isomer depletion from the primary reactions. In such a low γ-ray background environment, the signature of isomer depletion is not observed, and an upper limit of 2×10^{-5} is estimated for the excitation probability. This is consistent with the theoretical expectation. This measurement was performed with lower recoiling energies than the previous experimental work. However, the discrepancy between the two experimental results also exceeds the theoretical expectation based on NEEC mechanism.
Further experimental investigations with low γ-ray background and high recoiling energies are necessary to verify if NEEC probability is large enough to be studied in the slowing down process. If not, one need considers to conduct measurements under resonance conditions.

[1] V. Goldanskii and V. Namiot, Phys. Lett. B 62 (1976) 393.
[2] P. Walker and G. Dracoulis, Nature 399 (1999) 35.
[3] C. J. Chiara et al., Nature 554 (2018) 216.
[4] Y. Wu et al., Phys. Rev. Lett. 122 (2019) 212501.
[5] J. Rzadkiewicz et al., Phys. Rev. Lett. 127 (2021) 042501.
[6] S. Guo et al, Nature 594 (2021) E1.

Auteur principal: GUO, Song (Institute of Modern Physics, Chinese Academy of Science, Lanzhou)

Orateur: GUO, Song (Institute of Modern Physics, Chinese Academy of Science, Lanzhou)

Déposé par **GUO, Song** le **jeudi 31 mars 2022**