channels, lifetimes of excited states in highly-charged nuclei can be prolonged, and may trun to measurable in some special case[3]. In this Letter, we report at least 6570% increase of the isomer lifetime of ^{92}Zr due to a large change in the internal conversion coefficient with increasing charge states. According to this gain we also identified a new level above the 8^+ state, which is inferred to be $3.3\sim3.6$ keV higher than the 8^+ level.

In the present work, the ^{12}C(^{86}Kr, 5n) fusion-evaporation reaction was employed at a beam energy of 559 MeV, and the residues were delivered to a low γ-background detection station via the radioactive ion beam line in Lanzhou (RIBLL) with a length of 35 m[4]. The gamma-spectrum in coincidence with the injected particle within a time window of 50 ns was extracted(see Fig. 1(a)). Four unexpected incoincident transitions, with energies of 935, 561, 1 462, and 352 keV, were observed, which have the same energies with first four corresponding transitions in the yrast band of ^{92}Zr. The correlated ^{92}Zr particle must arrive in another excitation state feeding the 8^+state, which has a short lifetime and cannot survive the flight. The lifetime of the conjected isomer is extracted to be less than 15 ns after it is stopped, but larger than 958 ns during the flight. We propose this big difference between the two lifetimes are mainly induced by the blocking of ICC. Calculations using shell model indicate that this conjected isomer is likely to based on a two-quasiparticle configuration involving intruder orbital, with a spin of 8 or 9. It can be the bandhead of a rotational band.

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3 - 6 Remeasuring ^{93m}Mo Isomer Depletion Probability in RIBLL1*

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In 100 years after the discovery of isomer in nuclei, it was continuously a prominent topic in nuclear physics[1]. Isomers with long lifetimes and high excitation energies are expected to represent a new source of nuclear energy. This stored energy is expected to artificially released by the process known as isomer depletion in which the isomer is excited to an adjacent excited state of shorter lifetimes and subsequently decays to the ground state promptly. However, the effective way to trigger isomer depletion remains elusive. Recently, Chiara[2] *et al.* reported the isomer depletion of ^{93m}Mo and attributed it to the Nuclear Excitation by Electron Capture (NEEC). Surprisingly, the estimated excitation probability, $P_{\rm exc}=0.010(3)$, was far beyond the calculated values, $P\sim10^{-11}$, in the following theoretical works[3]. Subsequently, Guo[4] *et al.*, pointed out that the heavy and complicated background was treated in an extraordinarily idealistic manner, which may cause the overestimation of the isomer depletion.

By comparing the experimental conditions of Fig. 1 (b) and (c), a lighter and simpler background environment is achieved in this work. ^{93m}Mo was produced at position T_0 through the ^{12}C(^{86}Kr, 5n) reaction and then was transported to T_2 using a secondary beamline with a length of 35 m[6]. After a transportation time of 1.14 μs, ^{93m}Mo was slowed down in the Carbon foil and finally stopped in the Plastic detector. The emitted γ rays were detected by five Ge detectors equipped with Compton-suppression shields.

The 268-keV gamma transition, which decays from an adjacent state with $I^{\pi}=17/2^+$ above the isomer by approximately 5 keV, is regarded as a fingerprint for the expected isomer depletion of ^{93m}Mo. Although it was not observed in the collected data during a 93-hour measurement, an upper limit of 2×10^{-5} was extracted for the excitation probability, which was in coincidence with the latest theoretical results.

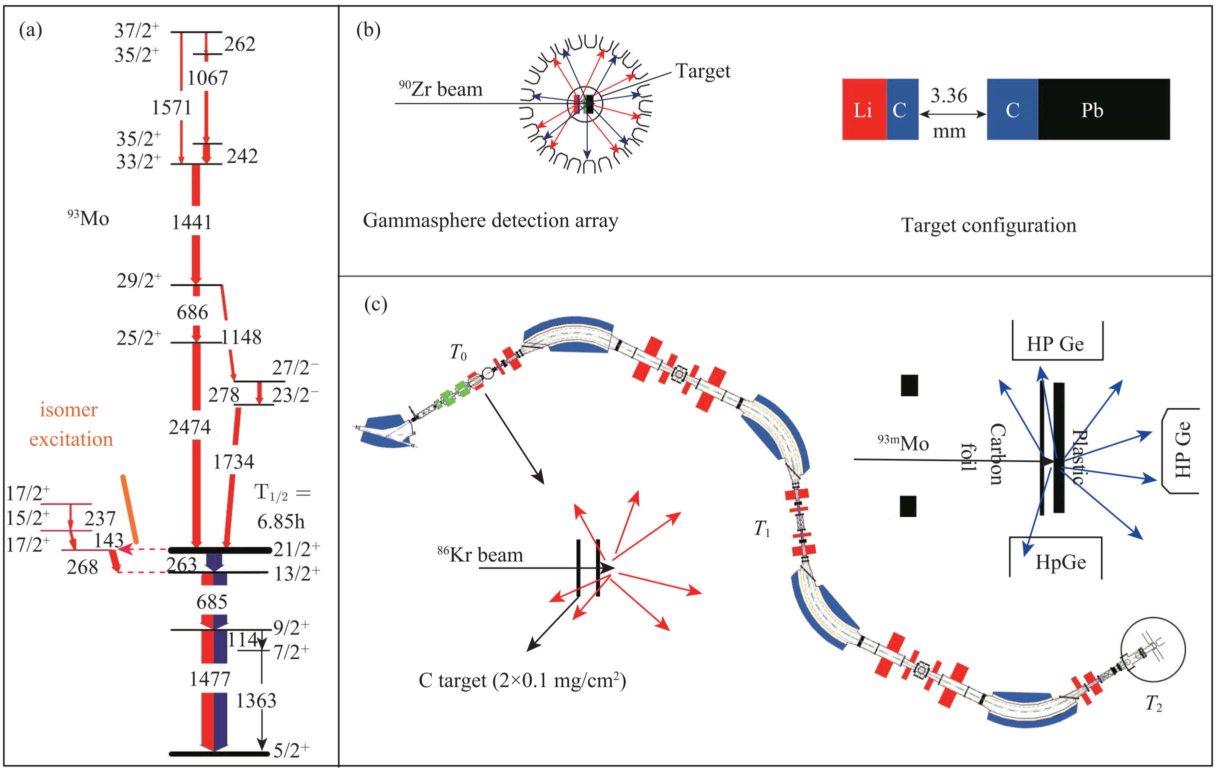

Fig. 1 (color online) (a) Relevant part of the ^{93}Mo decay scheme, (b) Experimental setup in the previous work[2], (c) Experimental setup in this work[5]. The blue and red arrows represent gamma transitions from long-lived isomer and promptly emitted after the states of ^{93}Mo were populated, respectively.

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