

Approaching the dominance of electron-capture delayed fission in ^{234}Bk and ^{230}Am

Zhiyuan Zhang^{1,2}

¹ *Institute of Modern Physics, CAS, Lanzhou 730000, China*

² *School of Nuclear and Technology, University of Chinese Academy of Sciences, Beijing 100049, China*

The first identification of the exotic decay process of Electron-Capture Delayed Fission (ECDF) of the very neutron-deficient isotope ^{234}Bk was performed, and improved ECDF properties for its alpha-decay product ^{230}Am were obtained at the gas-filled recoil separator SHANS2. The isotope ^{234}Bk was produced in the fusion-evaporation reaction $^{40}\text{Ar} + ^{197}\text{Au} \rightarrow ^{237}\text{Bk}^* \rightarrow ^{234}\text{Bk} + 3n$.

By using the method of temporal and position correlations, different decay channels of ^{234}Bk and ^{230}Am isotopes were investigated and a wealth of new experimental information was obtained.

The highest ECDF probabilities among all beta- or EC-delayed fission cases known so far are reported, showing the tendency of approaching the expected saturation towards $P(\text{ECDF})=1$. The comparison of the $P(\text{ECDF})$ systematics with two theoretical fission models shows significant discrepancies in respect of corresponding fission barrier values. Meanwhile, the analysis of the ECDF probabilities in the heavy actinides and lead region suggests the similar ECDF mechanism in both cases. The need for a theoretical framework that can provide realistic beta-delayed fission probabilities for astrophysical predictions is strongly underlined.

References

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