2 - 2 Lifetime Measurement of the Low-lying Excited States $7/2^+_1$ in 87 Zr

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Lifetime measurements of low-lying excited states in ⁸⁷Zr have been performed via $\beta - \gamma$ coincidences. The 127 MeV ³²S beam was delivered from the Sector-Focusing Cyclotron (SFC) of the Heavy Ion Research Facility in Lanzhou (HIRFL). The parent nuclei ⁸⁷Nb were produced by the reaction ⁵⁸Ni (³²S, 2p1n), at a beam energy 127 MeV through a 8 µm Al degrader. A 200 µg/cm² layer of ⁵⁸Ni evaporated onto a 200 µg/cm² thick carbon foil was employed as the target. After evaporation residues were separated from the projectile beams by the gas-filled recoil separator SHANS^[1], the nuclei of interest ⁸⁷Zr can be obtained with a higher purity and then were implanted into a 300 µm silicon detector. The emitted β^+ particles and γ rays following β^+ decay were detected by a 3 µm plastic scintillator at 0°, and three LaBr₃ and one high purity germanium (HPGe) detectors at 90° to the beam axis, respectively; the average distance from the front face of the detectors to the center of the silicon detector was approximately 10 cm Characteristic γ rays were detected by the HPGe detectors to identify the ⁸⁷Zr nuclei. When



rays measured with the plastic scintillator and the 201keV full energy γ-ray accepted in the LaBr₃ crystal.

References

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the plastic scintillator and at least one LaBr₃ detectors were fired in the same time, the time and energy signals from the detectors were recorded as an event. The energy calibration was made by using 207 Bi sources for the plastic scintillator and 60 Co, 133 Ba and 152 Eu sources for the LaBr₃ and HPGe detectors.

The lifetime of the level at 200.9 keV in ⁸⁷Zr has been extracted by fitting the time spectra using the exponential-folded Gaussians plus a horizontal background^[2,3]. The time spectra were showed in Fig. 1. The $\beta - \gamma$ coincidences give a mean lifetime $\tau = (968 \pm 12)$ ps for the 200.9 keV level in ⁸⁷Zr, which is very different from the published value $\tau = (3.52 \pm 0.14)$ ns in Refs. [4, 5]. The reasons would be checked in the forthcoming work.