Lifetime of the ^{99}Rh $7/2_1^+$ state from fast-timing measurements*

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Over the last decade, the structure of lowest-lying excited states in A∼100 nuclei was systematically studied [1,2,3] via recently developed in-beam fast-timing method (IBFTM) [4] which is sensitive to picosecond lifetimes of excited nuclear states. The method opened new opportunities to study the evolution of collectivity and changes in the inner nuclear structure with the spin and the particle occupation numbers. In particular, in-beam fast-timing measurements were performed in series of odd-mass Ru [2], Pd [1], and Cd [3] nuclei allowing for a more detailed systematical study of the nuclear structure at low excitation energies. With the present study, we further investigate the $^{99}_{45}$Rh$_{54}$ $7/2_1^+$ state. This nucleus is placed in a mass region where on-set of quadrupole deformation is observed.

The new data is derived from an experiment performed at IFIN-HH (Romania). A 32 MeV ^{6}Li beam was impinged on 10 mg/cm^2 thick target enriched in ^{96}Mo. The nucleus was produced in ^{96}Mo(^{6}Li,$3n\gamma$) reaction and the γ-rays emitted were detected by the hybrid RoSphere multidetector array comprising 11 $LaBr_3$:Ce and 14 HPGe. The system was triggered by triple coincidences between two $LaBr_3$:Ce and one HPGe detectors allowing for unambiguous selection of the reaction channel and γ-decay path. The new data will be discussed within the Triaxial-rotor plus particle model framework which, in the past, has provided a good understanding of the medium-mass rhodium nuclei.

Besides the pure nuclear structure interest [6], the new data is of potential interest for nuclear astrophysics applications. Low-lying excited states are excited in hot stellar environment [5], leading to changes in their stellar half-lives, which on their turn can significantly alter the stellar nuclear reactions path. ^{99}Rh is on the astrophysical p-process path.

[1] D.Ivanova, S.Lalkovski, C.Costache, S.Kisyov, C.Mihai, N.Marginean, P.Petkov, *et. al.*, Phys.Rev. **C105** (2022) 034337

[2] S.Kisyov, S.Lalkovski, D.Ivanova, N.Marginean, D.Bucurescu, *et. al.*, Bulg.J.Phys. **42** (2015) 583

[3] S.Kisyov, S.Lalkovski, N.Marginean, D.Bucurescu, *et. al.*, Phys.Rev. **C84** (2011) 014324

[4] N.Marginean, D.L.Balabanski, D.Bucurescu, S.Lalkovski, , *et. al.*, Eur.Phys.J. **A46** (2010) 329

[5] Ch.Iliadis, *Nuclear Physics of Stars*, Wiley, 2015

[6] D.Bucurescu, G.Cata, D.Cutoiu, G.Constantinescu, M.Ivascu, N.V.Zamfir, Nuclear Physics **A443** (1985) 217

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