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Lifetime measurements in exotic nuclei at Lohengrin

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Lifetimes of nuclear excited states are key observables to study nuclear structure properties, such as the interplay between single-particle and collective degrees of freedom and more complex phenomena as the coexistence of different shapes at similar excitation energies. In this context, neutron-rich nuclei are particularly challenging and neutron-induced fission experiments offer a unique opportunity to explore more exotic regions of the nuclide chart. Although lifetimes can be successfully measured using prompt γ rays [1], the weakest channel would benefit from the selection and the identification of fission fragments. This can be achieved with the Lohengrin spectrometer [2] at Institut Laue-Langevin, where the γ decay of long-lived isomeric states can be studied at the focal plane of the mass separator.
In this work, we present recent results obtained in different ^{235}U neutron-induced fission campaigns at Lohengrin, using a hybrid setup made of HPGe clover detectors and $LaBr_3$ scintillators. The latter were used to measure lifetimes, down to a few ps, using γ-ray fast-timing techniques [3]. In particular, results on ^{131}Sb [4] and ^{96}Rb [5] will be discussed. In the first case, the lifetime of the $11/2^+$ state was measured, yielding $T_{1/2}$ = 3(2) ps, the first such result in neutron-rich antimony nuclei and one of the shortest ever measured in beam with this experimental technique. Consequences on the origin and development of collectivity in the vicinity of the doubly magic ^{132}Sn nucleus will be presented in the framework of the shell model. In the second case, particular emphasis will be given to the observation of a retarded E2 transition deexciting the 4^- state at 554.5 keV in ^{96}Rb, for which a lifetime of $T_{1/2}$ = 599(55) ps was measured. This γ ray connects the strongly deformed band above 450 keV with near-spherical low-lying states. Its impact on the shape-coexistence phenomenon in this exotic mass region around N=60 will be addressed.

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