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Nuclear shape evolution through lifetime measurement in neutron rich nuclei

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A new interest for exotic nuclei further away from the valley of stability arises due to the possibility to use refined experimental methods. In particular, the neutron rich side of the valley still offers a lot of interesting features to be discovered. Our recent experiments on nuclei around A = 100 aim at discovering part of these features trough lifetime measurements and will help understanding nuclear shape evolution in neutron rich nuclei. In this mass region, shapes are changing rapidly, which is reflected in the theoretical calculations by the prediction of occurrence of prolate, oblate, or triaxial shapes. These predictions vary as a function of the theoretical model used, thus experimental measurements will have important implications.
The neutron-rich isotopes were produced trough a fusion-fission reaction performed at GANIL in inverse kinematics with a 238U beam. The aim of this experiment was to extend information on the evolution of the collectivity in this mass region by measuring the lifetimes of excited states in more neutron-rich nuclei and up to higher spins. A and Z identification of the fission fragments was performed with the VAMOS spectrometer, while the EXOGAM spectrometer was used for the γ-ray detection. The RDDS (Recoil Distance Doppler Shift) method has been applied to extract the lifetime of excited states. To our knowledge this is the first experimental attempt to perform a RDDS experiment on fission fragments, which are identified in A and Z on an event-by-event basis. Results on the complex analysis performed to achieve the identification of the fission fragments up to Z=54 and A=150 and on the new lifetime values will be presented.
A complementary experiment has been performed recently at ILL to measure lifetimes of excited states in the same range of nuclei but populated with a neutron induced reaction on a Pu target. Lifetimes have been measured via the fast-timing method using LaBr3 detectors and the EXOGAM array, which will extend the range of measurable lifetimes to ns. This will give information either on the deformation or on the role of the triaxiality in these nuclei.

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