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Lifetimes of excited states in neutron-rich Zn isotopes using the AGATA demonstrator

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The spectroscopy of exotic nuclei offers the opportunity to investigate the isospin dependence of the nuclear structure. The structure of N=40 nuclei away from stability is currently questioned [1]. Even though 68Ni shows signs of magic nucleus with a large first 2+ excitation energy and a small transition probability B(E2; 2+->0+), recent experiments point towards a rapid onset of collectivity and deformed shapes for Cr, Fe, Zn and Ge isotopes. The description of collectivity in this mass region seems to require the g9/2 and d5/2 orbits in the valence space in case of shell model calculations [2]. In neutron-rich copper isotopes 73,75Cu excitations have been shown to contain both single-particle and collective components [3].
In this context, lifetime measurement of the first excited states in 70,72,74Zn have been performed through a recoil-distance Doppler shift method (RDDS). The experiment, carried out at the Laboratori Nazionali di Legnaro in Italy, is one of the first performed with the AGATA demonstrator, first stage of the AGATA new-generation germanium array. A 76Ge beam at 577 MeV impinging on a 238U target has been used to produce the Zinc isotopes from deep-inelastic scattering. Results suggest a maximum of collectivity at N=42 and an unexpectedly long lifetime is measured for the 4+ state in 74Zn leading to a very small ratio of B(E2; 4+->2+)/B(E2; 2+->0+). This could be link to an onset of single-particle components in the excitation. The comparison with theoretical calculations will be discussed in the presentation.
[1] J. Ljungvall et al, Phys. Rev. C 81, 061301 (R) (2010)
[2] K. Sieja and F. Nowacki, Phys. Rev. C 81, 061303 (R) (2010)
[3] J.M. Daugas et al, Phys. Rev. C 83, 054312 (2011)

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