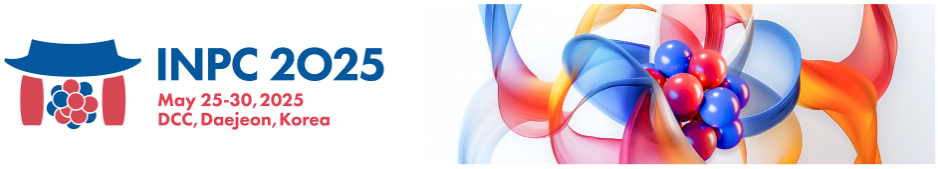

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Excited States Lifetime measurements in neutron-rich Ca, Ar isotopes: impact on the shell evolution along N=28 and Z=20

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Excited States Lifetime measurements in neutron-rich Ca, Ar isotopes: impact on the shell evolution along N=28 and Z=20

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The region around doubly magic ^{48}Ca is a cornerstone of our understanding of nuclear structure, characterized by the appearance of subshell closures at N=32 and 34 [1], and by the gradual disappearance of N=28 shell closure below Z=20 [2]. However, several experimental findings have challenged this understanding. Large charge and matter radii were found in $^{51-52}$Ca [3,4], showing insensitivity to the N=32,34 subshell closures. The long-standing conundrum of the small B(E2) value in ^{46}Ar [5,6] has recently been attributed to a new proton sub-shell closure at Z=18 in ^{46}Ar [7].
We measured lifetimes of excited levels in $^{50-(52)}$Ca and $^{46-(48)}$Ar isotopes (and other nearby nuclei) produced in a multi-nucleon transfer reaction at the Legnaro Laboratories. A beam of 48Ca at 300 MeV impinged on a ^{238}U target and the target-like recoils were identified event-by-event in mass and atomic number by the mass spectrometer PRISMA [8]. Gamma rays were measured in coincidence with reaction recoil with the AGATA γ-ray tracking array [9]. Lifetimes were measured using the recoil differential Doppler shift method by mounting the uranium target on a plunger device. Shorter lifetimes were probed using the differential Doppler shift attenuation technique, using a ^{238}U target with a thick niobium backing. Thanks to the cutting-edge AGATA resolving power, the lifetimes of several yrast and yrare states with spin ≤ 4 were measured.
We will present preliminary results concerning the lifetimes of excited states in ^{46}Ar and 50Ca, comparing them with shell-model calculations with the interactions available in this region, also including three-body effects. We will discuss the measurement impact on the neutron $f_{5/2}$ shell evolution towards N=34 as well as on the proposed proton subshell closure in ^{46}Ar [7]. We will also discuss possible fingerprints of the large neutron $p_{3/2}$ shell radius [10] in γ-ray spectroscopy.

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