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Robustness of the N=34 shell closure: First spectroscopy of 52Ar

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It is now well known that the magic numbers are not universal across the nuclear landscape and that new shell closures may emerge in nuclei far from stability. In particular, a new subshell closure at N=34 has been reported in 54Ca. While the systematics of the E(2+) of the Ti isotopes does not show any evidence for the existence of the N=34 subshell closure, the significant 2+ excitation energy in 54Ca was a sign of its doubly magic character. For 52Ar, no spectroscopic information has been measured, however, its E(2+) was predicted to be the highest among Ar isotopes with N > 20, suggesting a robust N=34 shell gap. The spectroscopy of 52Ar thus offers a unique chance to explore the robustness of the N = 34 subshell closure and pin down the mechanism at the origin of its emergence.

The measurement of 52Ar was performed at RIBF at RIKEN using the spectrometers of BigRIPS and SAMURAI. The low-lying states of 52Ar were populated via 53K(p, 2p) and 54Ca(p, 3p) reactions at ~240 MeV/u. The selectivity of the (p, 2p) and (p, 3p) channels is used to build the level scheme of 52Ar. The challenge posed by the low secondary beam intensity was tackled by the combination the MINOS device with a 150-mm thick liquid hydrogen target and the recent upgraded high efficiency DALI2+ gamma detector array. In the presentation, we will report on the first in-beam gamma spectroscopy of low-lying states of 52Ar, and discuss the robustness of the N=34 shell closure in light of shell model and ab initio calculations.

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