

Restoration of the natural $E(1/2^+) - E(3/2^+)$ energy splitting in odd-K isotopes towards $N=40$ (ZOOM)

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I will report on the first γ -ray spectroscopy of $^{51,53}\text{K}$ produced from $^{52,54}\text{Ca}(p,2p)$ reactions at ~ 250 MeV/nucleon at RIBF at RIKEN. The $1/2_1^+ \rightarrow 3/2_1^+$ transitions in $^{51,53}\text{K}$ were clearly observed [1], providing important information to understand the monopole drift effect of the proton $1d_{3/2}$ and $2s_{1/2}$ orbitals along the odd-K isotopic chain. Thanks to the MINOS setup based on reaction vertex tracking combined with a thick-hydrogen target [2], the final-state angular-momentum of $^{51,53}\text{K}$ were determined unambiguously by comparing the shapes of the experimental exclusive parallel momentum distributions to distorted-wave impulse approximation calculations. $3/2^+$ ground states and $1/2^+$ first excited states in $^{51,53}\text{K}$ were established quantifying the natural ordering of the $1d_{3/2}$ and $2s_{1/2}$ proton-hole states that are restored at $N=32$ and 34 . State-of-the-art ab initio calculations and shell-model calculations with improved phenomenological effective interactions reproduce the present data and predict consistently the increase of the $E(1/2_1^+) - E(3/2_1^+)$ energy differences towards $N=40$.

[1] Y. L. Sun et al., Phys. Lett. B 802, 135215 (2020).

[2] A. Obertelli et al., Eur. Phys. J. A 50, 8 (2014).

Primary author: Dr SUN, Yelei (Technische Universität Darmstadt)

Presenter: Dr SUN, Yelei (Technische Universität Darmstadt)

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