

# Structure of $^{110}\text{Zr}$ - first spectroscopy and its implications for shell evolution and the r-process

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A predicted  $Z=40$  subshell closure in  $^{110}\text{Zr}$  has long been considered a potential explanation for the excess of elemental abundances before the  $A=130$  r-process peak. We performed the first spectroscopy of this nucleus at the RIKEN-RIBF facility, populating the low-lying levels via  $(p,2p)$  knockout and measuring the energies with the MINOS tracker and DALI2 NaI array. We will present first spectroscopy results,  $^{111}\text{Nb}(p,2p)^{110}\text{Zr}$  and  $^{112}\text{Mo}(p,3p)^{110}\text{Zr}$  cross sections, complementary analysis of neighboring nuclei, implications for structural evolution in the  $50 < N < 82$  region, and the impact on our understanding of the formation of the  $A=130$  r-process peak. Additionally, we report on a broader, ongoing study of  $(p,2p)$  and  $(p,3p)$  quasi-free scattering cross sections as measured during the SEASTAR (Shell Evolution And Search for Two-plus energies At RIBF) campaigns.

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