RECENT RESULTS ON VERY NEUTRON-RICH $A \sim 50$ NUCLEI FROM RIBF

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Recent investigations of exotic $N = 32$ and 34 nuclei have highlighted the presence of sizable subshell closures at these neutron numbers that are absent in stable isotones. The onset of a new subshell closure at $N = 34$ was recently reported in ^{54}Ca [1], while previous experimental studies focused on the development of subshell gaps at $N = 32$ along the Cr [2, 3], Ti [4, 5], and Ca [6–8] isotopic chains. On the theoretical side, these subshells gaps were investigated, for example, in the framework of tensor-force-driven shell evolution [9]; as protons are removed from the $\pi f_{7/2}$ orbital, the $\nu f_{5/2}$ state becomes progressively less bound and shifts up in energy relative to the $\nu p_{3/2}$–$\nu p_{1/2}$ spin-orbit partners. It has also been reported that no significant $N = 34$ gap exists in Ti isotopes [5, 10], despite the fact that an inversion of the $\nu f_{5/2}$ and $\nu p_{1/2}$ orbitals has been noted [11]. The strength of the $N = 34$ closure in Sc isotopes, which contain only one proton in the $\pi f_{7/2}$ orbital, provides further input on the location of the $\nu f_{5/2}$ orbital and the evolution of the $N = 34$ subshell gap in exotic systems. Moreover, the low-lying structures of Ar isotopes, which are presently reported up to ^{50}Ar [12], provide information on the strength of the $N = 32$ closure at $Z < 20$. In the present work, the low-lying structures of $A \sim 50$ nuclei were investigated using in-beam γ-ray spectroscopy employing a variety of reactions including nucleon knockout, inelastic scattering, and charge exchange reactions with fast radioactive projectiles to help shed light on the evolution of the $N = 32$ and 34 subshell closures in nuclei far from stability. New experimental results on ^{54}Sc, ^{55}Sc, and ^{56}Sc will be presented here, and modern shell-model calculations will be discussed. The presentation will conclude with potential plans for future measurements in this mass region at the RIBF.

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