On the evolution of the neutron $0d_{5/2}$ and $1s_{1/2}$ orbitals in neutron-rich $0p$-$1s0d$ shell nuclei*

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A detailed look into the evolution of the $0d_{5/2}$ and $1s_{1/2}$ neutron orbitals has been performed using the ^{19}O(d,p) and ^{17}N(d,p) reactions at beam energies of 6.6 MeV/u and 13.5 MeV/u, respectively. The experiments were carried out in inverse kinematics with radioactive beams produced by the ATLAS in-flight facility, and protons in coincidence with heavy ion recoils were detected by the helical orbit spectrometer (HELIOS) [1]. Eight levels in ^{20}O, including a previously unobserved $J^\pi = 3^+$ level at $E^* = 5.23$ MeV, and at least three states in ^{18}N, were observed with measurable strengths. Q values were measured with an energy resolution of ~200 keV, and spectroscopic factors were extracted from angular distributions through a distorted wave Born approximation analysis. Results from the ^{19}O$(d,p)^{20}$O reaction established the $\ell = 0$ and 2 strength distributions in this region, and allowed for the determination of the $J = 0, 2$ and 4, $T = 1$ $\langle (0d_{5/2})^2 J|V|(0d_{5/2})^2 J\rangle$ empirical two-body matrix elements of the NN interaction. Identification of $0d_{5/2}$ and $1s_{1/2}$ dominated levels in ^{18}N, those having large overlaps with the ^{17}N ground state, illuminates the $N = 11$ transition region between ^{19}O, which has a $J^\pi = 5/2^+$ ground state and a high lying $1/2^+$ excited state, and the exotic $J^\pi = 3/2^+$ ^{17}C nucleus [2]. In addition to empirical systematics, results will be discussed in terms of modern $0p$-$1s0d$ and $1s0d$ confined shell-model interactions, as well as their impact on clarifying the underlying mechanisms leading to the evolution of the magic numbers [3].

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