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Structure of N=Z nuclei in single j shell calculations

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I discuss calculations of states with angular momentum zero in nuclei with equal numbers of neutrons and protons and either four or eight nucleons or nucleon holes in the 1f7/2 or 1g9/2 shell with effective interactions from the literature. Consistently and fairly independently of the interaction, the ground states have by about 75% seniority zero in Flowers's classification of states in a single j shell by a seniority and a reduced isospin. This structure may be seen as the manifestation of isovector pairing in this model. The rest of the ground state configuration has entirely or almost entirely seniority two and reduced isospin zero. Configurations constructed from pairs of a neutron or neutron hole and a proton or proton hole aligned to the maximal angular momentum have overlaps of 25%-62% with the seniority zero state. This illustrates that the Pauli principle prohibits a perception of isovector and isoscalar pairings as being mutually exclusive. The states with aligned neutron-proton pairs largely select by projection the components of the calculated ground states from multidimensional spaces with a given seniority and reduced isospin zero. By calculating the binding energy as a function of isospin with modified interactions where certain components are omitted, one finds that - contrary to suggestions in the literature - the isoscalar interactions are responsible for the symmetry energy rather than the Wigner energy.

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