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Seniority scheme for j=9/2 orbitals

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The seniority scheme assumes that the low lying states in a nucleus can be described considering one single orbital, and there is no seniority mixing. The aim of the present paper is to test the validity of this, by focusing on the reduced B(E2) transition strengths, considered to provide more stringent test of the wave function than the excitation energies.

The largest amount of experimental data on seniority is related to j=9/2 orbitals. The proton g9/2 orbital between the Z=40 sub-shell and the Z=50 shell closures is isolated from other orbitals, therefore the N=50 nuclei with Z=42-48 provide a stringent test of seniority. Similarly, the proton h9/2 orbital is the first one above the Z=82 magic number, while the neutron g9/2 is first above N=126, making the N=126 isotones and the neutron-rich Z=82 Pb isotopes good test cases.

All available data, both on even- and odd-mass nuclei, were considered. The seniority scheme provides a good approximation for all these three regions, with the best fit given by the lead isotopes. In addition, shell model calculations using well established interactions were performed. In the N=50 and Z=82 considering all orbitals within a shell provide only a limited improvement in reproducing the data when compared to the seniority scheme. In contrast, the shell model provides much better agreement for N=126 nuclei, where the proton f7/2 orbital has increasing effect on the transition strengths as the j=9/2 orbital is filled. In order to further test whether the lead isotopes provide the best example of the seniority scheme, and investigate the possible effect of the neutron i11/2 orbital, more experimental information is required, especially for 214,215,216Pb.

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