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$j-1$ anomalous states in silver nuclei

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Abstract

The $j-1$ anomaly observed in some silver nuclei has attracted significant experimental and theoretical interest in the past 60 years [1–5]. The anomaly is expressed by the unusual ordering of the j and $j-1$ states arising from the spherical shell model j^{-3} multiplet, split under unusually strong $Q.Q$ residual interaction [5]. In the mass regions placed away from doubly magic nuclei, the $j-1$ levels appear in energy below the respective j states. The effect is most prominent in the silver isotopic chain where the $(7/2^+, 9/2^+)$ doublet arises from $\pi g_{9/2}^{-3}$ configuration, but it is not unique for silver nuclei. It is also observed in other systems with pure three-hole configurations. In these nuclei, the splitting $\Delta E = E_{j-1} - E_j$ and the E_{2^+} core energies of the neighbouring even-even nuclei are correlated [6]. Indeed, such a correlation is well pronounced in the (28,50) neutron and proton shells, and to a lesser extent in the lower and higher (20,28) and (50, 82) shells.

To study the nature of the anomaly and the evolution of the lowest energy states of the $\pi g_{9/2}^{-3}$ multiplet we have studied the structure of the ^{115}Ag produced in spontaneous fission and the structure of the ^{103,105}Ag nucei [7], produced in fusion/evaporation reactions. Preliminary results from these data will be presented and discussed in the framework of empirical single-j Shell Model, Rigid-Triaxial Rotor plus Particle Model and Interacting Boson-Fermion Model calculations.

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References

[1] A.de Shalit, I.Talmi, *Nuclear Shell Theory*, Academic Press, New York, 1963
[2] L.S. Kisslinger, Nuclear Physics **78** (1966) 341
[3] V. Paar, Nucl. Phys. A211 (1973) 29
[4] L.-G. Svensson, *et. al.*, Physica Scripta **14** (1976) 129
[5] A.Escuderos, L.Zamick, Phys.Rev.**C73** (2005) 044302
[6] S.Lalkovski, S.Kisyov, Phys.Rev.**C106** (2022) 064319
[7] I.Vasilev *et al.*, these proceedings