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Seniority in atomic nuclei

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Seniority refers to the number of nucleons that are not in pairs coupled to angular momentum $J=0$. As shown by Racah in the 1940s, it is a symmetry exhibited by the pairing interaction and, more generally, it is a quantum number approximately conserved for a general interaction between either neutrons or protons. In this talk I review the conditions for the conservation of seniority and show that they are a manifestation of particle-hole symmetry.

Many properties of nuclei can be understood with simple arguments based on seniority and some of them will be discussed in this talk. In particular, the symmetry of seniority gives rise to selection rules in the electromagnetic decay in nuclei that may lead to the formation of isomers. Another topic of interest concerns the relation between $B(E2)$ values in even-even and odd-mass nuclei in the shell model as opposed to the predictions of the particle-core coupling model. Finally, the question of (state-dependent) effective $E2$ charges in the shell model will be addressed.

Primary author: VAN ISACKER, Piet (GANIL)

Presenter: VAN ISACKER, Piet (GANIL)

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