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Single j-shell studies of cross-conjugate nuclei and isomerism

LARRY ZAMICK, ALBERTO ESCUDEROS, Rutgers University — In the single j-shell with the same interaction cross-conjugate pairs should have identical spectra. There are differences. For the lighter members of cross-conjugate pairs of four nucleons with $T=1$ The ground state spin is two for the heavier members it is $(2j-1)$. This result can be obtained by using the spectrum of 2 particles as an effective interaction for the lighter member and the spectrum of 2 holes for the heavier member. But what is most new in this work is the observation in many single j-shell calculations and some experiments of criss-cross behavior. The $J=2$ state in the heavier member, if not the ground state is still low lying and hence isomeric. Likewise the $(2j-1)$ state in the lighter member is also low lying and is isomeric. An exception to the isomers comes when $J=(2j-1)$ differs from $J=2$ by two units or less. A key point in the difference of the particle-particle and the hole-hole interaction is that in the latter the state with $J^{max}=2j$ is much lower than in the former. In ^{44}Sc the $J=2$ state is calculated to be the ground state and in ^{52}Mn $J=6$. But $J=6$ is at 0.381 MeV in the former and $J=2$ at 0.202 MeV in the latter. In ^{96}Ag $J=(2j-1)=8$ is the ground state and $J=2$ is at 0.097 MeV. $J=15$ is also isomeric. We thus have a $(2j-1)$ rule.

Larry Zamick
Rutgers University

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