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 \( J_{\text{max}}=2j \) is much lower than in the former. In \(^{44}\text{Sc}\) the \( J=2 \) state is calculated to be the ground state and in \(^{52}\text{Mn}\) \( J=6 \). But \( J=6 \) is at 0.381 MeV in the former and \( J=2 \) at 0.202 MeV in the latter. In \(^{96}\text{Ag}\) \( J=(2j-1)=8 \) is the ground state and \( J=2 \) is at 0.097 MeV. \( J=15 \) is also isomeric. We thus a \((2j-1)\) rule.

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