The $K$ quantum number in the Shell Model—$^{50}$Cr SHADOW
ROBINSON, U. Southern Indiana, ALBERTO ESCUDEROS, LARRY ZAMICK, Rutgers U. — It was suggested [1,2] that the $10^+_{1}$ state in $^{50}$Cr at 6.340 MeV does not belong to the $K = 0^+$ g.s. band. In [1] it is noted that the static quadrupole moments of the $J = 2^+_1-8^+_1$ states are all negative, but that of $10^+_1$ is positive. While Ref. [1] suggested that the $10^+_1$ state belongs to a high $K$ prolate band, in Ref. [2] they assign it as $K = 10^+$. There is a nearby second $10^+$ state. However, the $B(E2)_{10^+_{1} \rightarrow 10^+_{1}}$ was not quoted by either group. In this work, we performed full $fp$ shell model calculations using four different interactions: FPD6, KB3, GXPF1, and GXPF1A. The results for $B(E2)_{10^+_{2} \rightarrow 10^+_{1}}$ are robust around $135 \text{ e}^2\text{fm}^4$ and suggest strong $K$ mixing. It is not clear what the $K$ value for the $10^+_2$ state is. With FPD6, $Q(10^+_{2})$ is negative, suggesting it is a member of the $K = 0^+$ band. But it is hard to understand how to get strong mixing of $K = 0^+$ and $K = 10^+$. With the other interactions, $Q(10^+_{2})$ is positive and thus inconsistent with a $K = 0^+$ (prolate) band. If we assume that the $10^+_1$ state has $K = 10^+$ and the $8^+_1$ state has $K = 0^+$, then the $B(E2)_{10^+_1 \rightarrow 8^+_1}$ would vanish. However, for the last three interactions, the corresponding $B(E2)$ is about $75 \text{ e}^2\text{fm}^4$, which implies substantial $K$ mixing. Thus, while a $K = 10^+$ assignment for the $10^+_1$ states makes the most sense in terms of energy systematics, in detail the situation is more complicated. [1] L. Zamick et al., Phys. Rev. C 53, 188 (1996); Phys. Rev. C 54, 956 (1996). [2] F. Brandolini et al., Phys. Rev. C 66, 021302(R) (2002).