

Spectroscopy of $^{65,67}\text{Mn}$: Strong coupling in the $N=40$ “island of inversion”

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Excited states in $^{63,65,67}\text{Mn}$ were studied via in-beam γ -ray spectroscopy following knockout reactions from ^{68}Fe . Similar level schemes, consisting of the $11/2^-$, $9/2^-$, $7/2^-$ and $5/2^-$ level sequence, connected by $I \rightarrow I-1$ transitions, were established, the first time for $^{65,67}\text{Mn}$. Their level structures show features consistent with strongly-coupled rotational bands with $K=5/2$. State-of-the-art shell-model calculations with the modified LNPS effective interaction reproduce the observed levels remarkably well and suggest the dominance of 4-particle-4-hole neutron configurations for all the states. The data on the low-lying excited states of odd-mass $^{53-67}\text{Mn}$ provide a textbook example of nuclear structure evolution from weak coupling through decoupling to strong coupling along a single isotopic chain on the n-rich side of the β stability line. These results help to deepen our understanding of the $N=40$ “island of inversion”.

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