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Low-energy level structures of neutron-rich Co, Fe, and Mn nuclei near $N = 40$[1]

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The region around $N = 40$ below Ni is currently an active area both experimentally and theoretically in an attempt to understand the rapid development of collectivity below ^{68}Ni as protons are removed from the $f_{7/2}$ single-particle state. The dramatic drop in the energy of the first excited 2^+ states and increase in the B(E2) values in even-even nuclei along the Fe and Cr isotopic chains has been well documented. The theoretical reproduction of the experimental trends indicates the increasing influence of the neutron $g_{9/2}$ single particle state as $N = 40$ is approached. The increased occupancy of the neutron $g_{9/2}$ single-particle level drives the nuclei below Ni towards deformed structures evidenced by the presence of low-energy isomeric states in nuclei with $N < 40$ and the drop in the energy of the yrast $9/2^+$ states in the neutron-rich Fe nuclei. Recently, investigations have been able to access the rich low-energy level schemes of odd-A and odd-odd nuclei along $N = 40$ and assign tentative spins and parities. The spin and parity assignments of these nuclei can serve as a signature of the underlying neutron and proton configurations and complement information obtained from neighboring even-even nuclei. For example, a low-energy $1/2^-$ isomeric state in ^{67}Co was taken as evidence of deformed proton states immediately below ^{68}Ni. To further explore this region, in particular the neutron states, the low-energy level structures of the odd-odd Co, Mn and odd-A Fe isotopes were studied through the beta-decay of the respective Fe, Cr, and Mn isotopes. The inferred level schemes based on both beta-delayed and isomeric gamma ray transitions of the odd-odd Co and Mn nuclei straddling $N = 40$ will be presented.

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