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Reordering of Nuclear Quantum States in Rare Isotopes

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A key question in modern nuclear physics relates to the ordering of quantum states, and whether the predictions made by the shell model hold true far from stability. Recent innovations in technology and techniques at radioactive beam facilities have allowed access to rare isotopes previously inaccessible to experimentalists. Measurements that have been performed in several regions of the nuclear chart have yielded surprising and dramatic changes in nuclear structure, where level ordering is quite different than expected from previous theoretical descriptions. In order to reconcile the difference between experiment and theory, new shell-model interactions have been proposed, which include the role of the tensor force as part of the monopole term from the expansion of the residual proton-neutron interaction. This has motivated a series of laser spectroscopy experiments that have studied the neutron-rich copper and gallium isotopes at the ISOLDE facility. This work has deduced without nuclear-model dependence the spin, moments and charge radii. The results of this work and their implications for nuclear structure near ^{78}Ni will be discussed.