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Shape Coexistence in Neutron-Rich Nickel Isotopes around $N = 40$[1] C.J. PROKOP, MSU/NSCL, E14039 COLLABORATION, E14057 COLLABORATION — Shape coexistence is a fascinating phenomenon in atomic nuclei characterized by multiple states with different intrinsic shapes coexisting at similar excitation energies. In even-even nuclei, a hallmark of shape coexistence is low-energy 0^+ states. In ^{68}Ni, the Monte-Carlo Shell Model (MCSM) employing the A3DA interaction, utilizing the $fpg_{9/2}d_{5/2}$model space for protons and neutrons, predicts triple shape coexistence with three 0^+ states below 3 MeV. Transitioning to ^{70}Ni, the energy of the prolate-deformed 0^+ state is predicted to drop precipitously from 2511 to 1525 keV. This is due to strengthening of the attractive $\nu g_{9/2} - \pi f_{5/2}$ and repulsive $\nu g_{9/2} - \pi f_{7/2}$ monopole interactions of the tensor force altering the effective single-particle energies of the $\pi f_{7/2}$ and $\pi f_{5/2}$ single-particle states, thereby reducing the spherical $Z = 28$ shell gap. Recent beta-decay spectroscopy experiments at the National Superconducting Cyclotron Laboratory (NSCL) have discovered a new excited 0^+ state at 1567 keV in ^{70}Ni. This result supports MCSM predictions extending the picture of shape coexistence to ^{70}Ni and demonstrates the importance of the tensor force for describing the nuclear structure of neutron-rich nuclei. Results of the latest NSCL experiments will be presented.

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C. J. Prokop
MSU/NSCL

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