Shape coexistence in and near $^{68}$Ni
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The nuclei in the vicinity of $^{68}$Ni have been the subject of considerable experimental and theoretical work focused on studying the evolution of nuclear structure. Situated at the $Z = 28$ proton shell closure and the fragile $N = 40$ subshell closure, $^{68}$Ni is an important nucleus to understand as a progression is made from stable to increasingly exotic nuclei. The nature and decay of the first excited state in $^{68}$Ni has been thoroughly investigated in recent years. The first excited state has a spin and parity of $0^+$, can be described by the excitation of neutrons across the $N = 40$ gap, and has been interpreted as a moderately oblate-deformed state that coexists with the spherical ground state. A second low-energy excited $0^+$ state is also known to exist in $^{68}$Ni. Based on comparisons with theoretical calculations, the second excited $0^+$ state has been proposed to be strongly prolate deformed and based primarily on the excitation of protons across the $Z = 28$ gap, leading to the inference that three different $0^+$ states with three distinct shapes coexist below 3 MeV in $^{68}$Ni. Additional studies suggest that shape coexistence is not unique to $^{68}$Ni in this neutron-rich region near $Z = 28$. For instance, in the neighboring even-even isotope $^{70}$Ni, theory predicts that a prolate-deformed minimum in the potential energy surface occurs at even lower energy than in $^{68}$Ni, and experimental evidence is consistent with the theoretical prediction. The results of recent experiments studying shape coexistence in the region, particularly investigations of $^{68,70}$Ni, will be presented and theoretical interpretations will be discussed.