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Isomers in even-Z nuclei below the N=82 shell

Around closed shells, intruder orbitals with large angular momentum difference and opposite parity compared to the ground state orbital lead to an accumulation of isomeric states. Below the $N = 82$ shell, low-lying states in the even-Z, $N = 81$ isotones are the $J^\pi = 1/2^+, 3/2^+$ and $11/2^-$ neutron-hole states, associated with the $s_{1/2}$, $d_{3/2}$, and $h_{11/2}$ orbitals, respectively. From $^{131}_{50}$Sn to $^{149}_{68}$Er, the $J^\pi = 11/2^-$ states are isomeric, in $^{129}_{48}$Cd this becomes the ground state [1]. In this chain of isomers, the excitation energy remains constant at 750 keV from $^{139}_{58}$Ce to $^{149}_{68}$Er, which is a unique feature on the nuclear chart for long-lived isomeric states.

Recently [2], this chain was extended towards the proton drip line using TITAN's multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) at TRIUMF. MR-TOF-MS are a powerful tool to discover long-lived isomers [4, 5] and study their properties [6]. Masses of neutron-deficient Yb isotopes including the ground and isomeric state in $^{151}_{70}$Yb were measured, and the excitation energy of the $J^\pi = 11/2^-$ isomer in $^{151}_{70}$Yb was thus derived. The new value falls in line with the observed systematics. State-of-the-art mean field calculations including shape degrees of freedom were performed to unravel the constancy of the excitation energies. The measurements and the theoretical results will be presented.

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