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Intertwined quantum phase transitions in odd-mass Nb isotopes

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The spectrum of odd-mass medium and heavy nuclei involving multiple shell model configurations have rarely been calculated by theoretical models thus far due to their demanding computational aspect or, for some models, the lack of an adequate framework. The evolution of structure of such odd-mass nuclei with varying number of nucleons is hence difficult to investigate. In this talk I will present the novel extension of the interacting boson-fermion model with configuration mixing (IBFM-CM), which we developed to address this gap of knowledge. The IBFM-CM is employed to calculate the evolution of structure of the odd-mass Nb isotopes ($Z = 41$) with A =93−105. Using this calculation we identify a quantum phase transition between the normal and intruder configurations (Type II QPT), which cross near neutron number 60. This serves as a first example of crossing configurations in odd-mass nuclei. Alongside the Type II QPT, we also identify the shape evolution (Type I QPT) within the intruder configuration, changing from spherical-like to deformed-like. The occurrence of both types of QPTs in the Nb isotopes points towards the manifestation of intertwined quantum phase transition (IQPT), for which a QPT involving a crossing of two configurations (Type II) is accompanied by a QPT involving a shape evolution of each configuration separately (Type I), similarly to the case of the adjacent even-even Zr isotopes ($Z = 40$).

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