Collective and Single-particle Structures In The Neutron-rich Doubly Mid-shell Nucleus 170dy

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One of the most successful descriptions of the structure of atomic nuclei is the spherical shell model. It, however, becomes impractical when moving away from closed-shell nuclei. Instead, it is the interplay between the macroscopic shape degrees of freedom and the microscopic nature of the underlying single-particle structure in a deformed basis that determines the nuclear structure. Being the heaviest nucleus precisely in the middle of, known, closed proton and neutron shells, $_{170}$Dy has become a central calibration point for tests of collective models of nuclear physics. However, besides one candidate transition from a previous experiment in Legnaro, Italy, no experimental information is available for this nucleus. Using the EURICA setup at RIKEN, which couples the world's highest intensity inflightfission facility with a high- efficiency HPGe array, an experiment in November 2014 produced $_{170}$Dy nuclei by in-flight fission of a $_{238}$U beam. The results from this experiment provide a wealth of information on this elusive nucleus, including the evolution of quadrupole collectivity, rigidity and higher order deformations, as well as the long sought for isomeric K=6$^+$ state, predicted to be exceptionally pure at mid-shell. This isomer was determined to have a reduced hindrance for its decay to the ground-state band an order of magnitude lower than predicted. This is interpreted as being due to γ-vibrational mixing from a near degeneracy of the isomer and the 6$^+$ state of the γ band.