

NATURE OF 0^+ STATES IN DEFORMED NUCLEI

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The nature of excited 0^+ states remains an open challenge in nuclear structure physics. A recent review by Heyde and Wood summarizes the difficulties that have emerged in understanding 0^+ states both from both the experimental and theoretical viewpoints. The assertions are that a complete characterization of 0^+ states requires in addition to the knowledge of energies and absolute transition probabilities, the measurements of transfer cross sections and E0 values. Traditionally, data on 0^+ states had been sparse until a recent (p,t) study by Leshner et al. established for the first time in a well-deformed nucleus, the existence of 13 excited 0^+ states in the ^{158}Gd nucleus resulting in a flurry of experimental and theoretical efforts to explain the possible nature of one of the most commonly occurring low-lying excitations in deformed nuclei. Traditionally, the first excited 0^+ bands were thought of as beta vibrational excitations build on a deformed ground state. Newer interpretations are many and include the possibility of phase changes exactly at nuclei where deformation sets in and the application of new symmetries to describe these nuclei.

New level lifetimes have been measured in the nucleus $^{156,160}\text{Gd}$, ^{162}Dy . We have measured lifetimes, angular distributions, and excitations of excited bands in $^{158,160}\text{Gd}$ using the (n,n') reaction at the University of Kentucky, while lifetimes in ^{156}Gd were measured using GRID at the ILL in France. We present our findings along with a possible explanation for the origin and characterization of low-lying 0^+ bands in deformed nuclei.