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The $N = 90$ shape phase transition and the critical point in the cerium isotopic chain

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Abstract

Both theoretical and experimental studies have been done on the $N = 90$ shape phase transition (PT) region the last two decades. Several symmetries and models describing nuclei in this region have been developed. Nuclei in the critical point of the PT between spherical vibrators and well-deformed rigid-rotors can be described by the X(5) symmetry [1]. Analytic solutions of the geometrical Bohr-Hamiltonian can describe nuclei before the critical point, like the X(5)-β^{2n} models [2], and after it, like the CBS rotor model [3]. The above mentioned symmetry and models describe axially symmetric nuclei, with $\gamma = 0°$. The entire transitional region can be mapped by the algebraic Interacting Boson Model (IBM)-1 [4,5], considering also axial asymmetric nuclei.

Key observables which can be accessed experimentally, such as energy and B(E2) ratios, have been measured in the region. From such information, the $N = 90$ isotones ^{150}Nd, ^{152}Sm, ^{154}Gd and ^{156}Dy have been identified as being close to the critical point of the PT.

In this presentation we will focus on the neutron-rich Ce isotopes, hence the low-Z boundary of the PT region. Energy data and lifetime data on ^{148}Ce from the EXILL&FATIMA campaign [6] will be compared to the respective models. Additionally, the region around $N = 90$ will be presented within the IBM. The shape evolution study of the cerium, the neodymium and the samarium chains shows the increasing axially asymmetry with decreasing atomic number and the importance of it in the determination of the critical point of the PT in each isotopic chain.

References

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