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A unified description of the shape phase transitions, shape coexistence and mixing phenomena in nuclei

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The Bohr-Mottelson Hamiltonian [1,2] has been numerically solved for a sextic oscillator potential in the β variable, for both stable and unstable γ-axial deformations [3,4]. The sextic potential, depending on its parameters, presents a single spherical minimum, a flat shape, a single deformed minimum and simultaneously spherical and deformed minima separated by a barrier (maximum) [5,6]. Therefore, the sextic potential is suitable to describe a shape phase transition and its corresponding critical point. Moreover, only by increasing step by step the barrier, which separates the two minima, one can cross from the critical point of the shape phase transition to the shape mixing and coexistence phenomena [7]. The model has also the ability to describe unusually small B(E2) transitions, observed in some nuclei, by assuming that states of the same band have different quadrupole deformation [8,9]. Until now, the model has been applied to a number of nuclei known to manifest such phenomena: 238Pu, 152Nd, 170Hf [3], 76Kr [7], 96,98,100Mo [4], 72,74,76Se [8], 74Ge, 74Kr [10], 80Ge [9] and 42,44Ca [11]. All these results are very promising for future applications and developments of the model.

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