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Shape transitions and low level structure in the Hg region within the relativistic density functional theory

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Quantum phase shape transitions and shape coexistence are one of the most active areas of theoretical and experimental research in nuclei [1]. Especially the region of neutron deficient Hg isotopes is a well known case, with recent experiments revisiting the area [2-5] and making it a suitable testing ground for theoretical models. Our approach is based on the relativistic density functional theory and its point coupling variants [6,7]. At the first level, constrained relativistic mean field calculations of even-even Hg and neighbouring nuclei such as Pt and Pb, provide the potential energy surfaces which reveal shape transitions along the isotopes as well as possible coexisting shapes as additional equilibrium points. At the next level, the constrained calculations are used as input for the construction of a five dimensional collective Hamiltonian (5DCH) [8], which introduces the vibrational and rotational collective dynamics neglected at the mean field level. This allows the detailed investigation of the low level structure of the collective spectra of Hg isotopes. In particular, energy ratios of levels of the same band and ratios of B(E2) transitions, that are used as signature of shape coexistence, are compared with experimental data and with calculations of other theoretical models.

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