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Microscopic description of collective excitations in atomic nuclei within the GCM framework

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The relativistic mean-field models, based on the energy density functionals theory and extended to include pairing correlations, provide a very good microscopic description of ground-state properties of atomic nuclei. However, in order to calculate excitation spectra and electromagnetic transition rates, it is necessary to take into account collective correlations that arise from symmetry restoration and fluctuations around the mean-field minima. The method of choice for this kind of calculation is the generator coordinate method (GCM), which enables us to calculate the collective spectra, wave functions, as well as expectation values of various observables that can in principle be compared to the experiment. In our calculations, relativistic Hartree-Bogoliubov model on a mean-field level is supplemented by the generator coordinate method with quadrupole and octupole deformations as generating coordinates in a beyond mean-field study of nuclear structure phenomena. Particularly, the questions of octupole correlations, which drive nuclei towards deformed pear-like shapes, and cluster formation, which can be considered as a transitional phase between the quantum liquid and crystal phases, will be addressed.

Auteur principal: M. MAREVIC, Petar (CEA, IPN)

Orateur: M. MAREVIC, Petar (CEA, IPN)

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