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Séminaire de Physique Nucléaire Théorique

Quadrupole-octupole collectivity and cluster structures in Neon isotopes

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The beyond mean-field models, that include collective correlations related to the restoration of broken symmetries and to fluctuations of collective variables, have become a standard tool for nuclear structure calculations. These models currently represent the only microscopic approach to the nuclear many-body problem that is applicable throughout the whole nuclide chart. In this talk we will present results of the recent beyond mean-field calculations based on the covariant density functional DD-PC1. Starting from a set of quadrupole-octupole deformed axially-symmetric relativistic Hartree-Bogoliubov states, the restoration of angular momentum and parity symmetries is carried out and the obtained states are subsequently mixed within the generator coordinate method approach. This model is then employed in a study of the lowest positive- and negative-parity bands of ^{20}Ne and neutron-rich even-even Neon isotopes. Overall a good agreement with the experimental excitation energies and transition rates is obtained. The contribution of cluster configurations to the low-energy states of ^{20}Ne is discussed, as well as the transitional character of the ground state. The analysis is extended to ^{22}Ne and the shape-coexisting isotope ^{24}Ne, and to the drip-line nuclei ^{32}Ne and ^{34}Ne. The role of valence neutrons in the formation of molecular-type bonds between clusters is discussed.

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