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Recent progress of shell-model calculations and quadrupole collective states

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While the shell-model calculation is one of the most powerful models to investigate the nuclear structure, the explosive increase of the dimension of the shell-model Hamiltonian matrix hampers us from applying it to heavy nuclei. To overcome this difficulty, we developed the Monte Carlo shell model (MCSM) and its extension, the quasi-particle vacua shell model (QVSM). These methods enable us to study the quadrupole collective states of medium-heavy nuclei. I will
review the recent progress of the numerical aspects of shell-model study and its application to the shape phase transition of the Nd and Sm isotopes. The nuclear matrix element of the neutrinoless double beta decay will also be investigated.

Experimental study on nuclear physics

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