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Shell Model description of nuclei: new frontiers

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The major challenge in the Shell Model framework is the diagonalization of the effective (generally two-body) Hamiltonian in the model space. Indeed, this is a huge task for open shell nuclei as the model space dimension grows combinatorially with the number of particles. In this talk, I will present our recent work aiming to tackle this problem in a deformed Hartree-Fock (HF) basis conserving good angular momentum. The construction of such basis can be done using mean field and beyond mean field techniques of the generator coordinate method (GCM) which has been extensively studied in the literature. However, the question of choosing relevant deformed HF states is not straightforward. For that, we have developed an efficient truncation scheme of the deformed HF basis which allow to apply the Shell Model in very heavy nuclear mass regions that are for now very difficult to do an exact diagonalization by standard methods. Benchmarks and several applications to nuclei from light, medium masses to superheavy ones will be presented.

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