The quadrupole collectivity is one of the most prominent aspects in the structures of both stable and exotic nuclei. The Interacting Boson Model (IBM) has been successful in reproducing experimental data by the phenomenological adjustment of its parameters. On the other hand, IBM has its own microscopic foundation, where the derivation of the parameters of IBM Hamiltonian has been done using the nuclear shell model mainly for (near-) spherical shapes [1].

We propose a new way to construct a Hamiltonian of IBM, using the mean-field model [2]. Quadrupole deformations in fermion system, indicated by a potential energy surface (PES) obtained by the constrained Skyrme Hartree-Fock calculations, are mapped, to a good approximation, onto the appropriate boson system (FIG. 1, Left). Energy spectra and wave functions are calculated with the exact treatments of angular momentum and particle number, which is a merit of the present method. The validity of the procedure is examined for well-known transitional nuclei, and its application is made for unexplored territory in the nuclear chart, that is, neutron-rich Pb-Hg-Pt-Os-W region with $A \gtrsim 200$.

The quantum shape-phase transitions from spherical to rotational shapes are well described for several isotopes both near and far from the stability line and the manifestations of recently proposed critical-point symmetries [3] are discussed (FIG. 1, Right). Configuration mixing in light Pb-Hg-Pt region isotopes are also investigated by the reasonable extentsions of the formulation.

FIG. 1: Left panel : Potential Energy Surfaces (PES) for $^{154}$Sm and $^{208}$W calculated by Skyrme Hartree-Fock and IBM. Right panel : Level evolutions in Sm and W isotopes.