Latest results of Hartree-Fock-Bogoliubov mass formulas

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The latest developments made in deriving accurate mass predictions within the microscopic Skyrme Hartree-Fock-Bogolyubov (HFB) approach are described. In particular, all our previous HFB mass models up to and including HFB-9 suffered from the defect of excessively strong pairing, as a result of the pairing parameters being fitted freely to the mass data. Within the same HFB framework, and maintaining the condition that neutron matter be fitted, we construct new models in which the pairing is constrained in such a way as to bring down the spectral pairing gap to be close to the experimental even-odd differences.

The interplay between the Coulomb and the strong interaction is also known to enhance the Coulomb energy at the nuclear surface [1]. This effect could be responsible for the Nolen-Schiffer anomaly, i.e the systematic reduction in the estimated binding energy differences between mirror nuclei with respect to experiment. To analyse this effect, the latest Skyrme force BSk14 has been refitted excluding the contribution from the Coulomb exchange energy, considering that the Coulomb correlation energy cancels the Coulomb exchange energy to an excellent approximation [1]. This Coulomb correlation effect is found to affect the nuclear mass predictions close to the neutron drip lines significantly.

The final effective forces are used to determine the nuclear structure properties (masses, deformations, radii, single-particle schemes, spin, ...) of all nuclei with $8 \leq Z \leq 110$ from the proton to the neutron drip lines. Such properties are compared with experimental data whenever available and with those predicted by other mass models.

In addition, a special attention in the determination of the latest effective forces is paid not only to the nuclear ground state and nuclear matter properties, but also to fission barriers. The full 3-dimensional energy surfaces have been calculated for $80 \leq Z \leq 98$ nuclei on the basis of our latest force and the static fission barriers compared with available experimental data.

[1] A. Bulgac, V.R. Shaginyan, Phys. Lett. **B469**,1 (1999)