

Accurate Nuclear Masses from a Three Parameter Kohn-Sham DFT Approach (BCPM)

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Given the promising features of the recently proposed Barcelona-Catania-Paris (BCP) functional [1], it is the purpose of this paper to still improve on it. It is, for instance, shown that the number of open parameters can be reduced from 4-5 to 2-3, i.e. by practically a factor of two. One parameter is tightly fixed by a fine-tuning of the bulk, a second by the surface energy. The third is the strength of the spin-orbit potential on which the final result does not depend within the scatter of the values used in Skyrme and Gogny like functionals. An energy rms value of 1.58 MeV is obtained from a fit of these three parameters to the 579 measured masses reported in the Audi and Waspra 2003 compilation. This rms value compares favorably with the one obtained using other successful mean field theories. Charge radii are also well reproduced when compared with experiment. The energies of some excited states, mostly the isoscalar giant monopole resonances, are studied within this model as well. As an application of this functional the Equation of State for neutron stars from the outer crust to the core is derived and the mass-radius relationship is discussed.

References

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