Ning Wang

We propose a global nuclear mass formula which is based on the macroscopic-microscopic
method, the Skyrme energy-density functional and the isospin symmetry in nuclear
physics. The rms deviation with respect to 2149 known nuclear masses falls to 336 keV,
even lower than that achieved with the best of the Duflo-Zuker models. The rms deviations
from 1988 neutron separation energies and alpha-decay energies of 46 superheavy
nuclei are significantly reduced to 286 and 248 keV, respectively. The predictive power
of the mass formula for describing new measured masses in AME2012 is excellent. With the proposed formula,
the shell corrections and nuclear charge radii of super-heavy nuclei are systematically investigated.
In addition, the slope parameter of nuclear symmetry energy is also extracted
based on the masses and charge radii of known nuclei.

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