Mass relations of mirror nuclei*

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Nuclear mass is a fundamental quantity of an atomic nucleus. Theoretically, many methods have been developed to describe and predict nuclear masses. Simple relations of masses between two mirror nuclei, which correlate to the difference of Coulomb energies, were suggested by Bao *et al.* in 2016 and were proved to be very accurate and useful in predicting masses of proton-rich nuclei with the mass number $A \leq 110$. These relations were improved by Zong *et al.* and Ma *et al.* in the past four years with the root-mean-squared deviations (RMSDs) between $70 \sim 147$ keV. This work gives further improvements, by considering the $1/N$- and $1/Z$-dependent terms (N and Z are the neutron and proton numbers) and the shell effect in the case of across a shell. Based on the newest AME2020 database, the RMSD of our improved relations is only 66 keV for masses of 116 nuclei with $N \leq 10$, and 98 unknown masses of proton-rich nuclei are predicted within competitive accuracy.

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