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Nuclear mass table based on Bayesian estimation of binding energy difference expressions

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Masses of nuclei constitute an important part of the nuclear data required by many astrophysical models. We describe a method of obtaining Bayesian estimates of difference expressions of nuclear binding energies for medium and heavy nuclei, such as the residual neutron-proton interaction energy Δ_{np} and the well-known Garvey–Kelson expressions, using the Markov chain Monte-Carlo (MCMC) algorithm. Tikhonov regularization approach is used to impose the theoretically expected requirement of smooth behaviour of the obtained estimates as a function of the nuclear mass number. With the help of these estimates an extrapolation of experimental nuclear masses from the AME database into the region of neutron- and proton-rich exotic nuclei is performed. The maximum range of extrapolation is determined by the estimated variance of the MCMC result and uncertainties of the experimental binding energies. The RMS error of masses of 65 new nuclei included in AME2020 in comparison with the prediction based on AME2016 amounts to 367 keV. The resulting mass values and nucleon drip lines are compared with other theoretical mass models at different values of the regularization parameter.

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