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# A new Gogny parametrization with 3 Gaussians suited for astrophysical applications

Despite major and numerous recent progresses in \textit{ab initio} calculations, it is not yet possible to describe ground state nuclear properties over the whole chart with this approach. Therefore, Energy Density Functionals remain the tool of choice to such end so far. If one wishes then to build a functional with free parameters suited for astrophysical applications, one must \textit{at least} describe nuclear properties, such as masses, as good as possible (\textit{i.e} with a root mean square to measured masses lower or equal to 800 keV), since they are of crucial importance for r-process for example \cite{rpro}, as well as infinite nuclear matter propeties of importance for neutron stars. Only this way, one can hope to extrapolate reliable properties up to the neutron dripline. \\
To this end, several competitive nuclear mass models based on Skyrme interaction within the mean-field framework, and fitted over measured nuclear masses essentially, have appeared over the years. Although they exhibit faithful advantages such as low computational cost, they are also intrinsicly penalized by required energy cut-offs to avoid non physical divergences. Gogny forces, designed mostly to overcome these problems, come then into play to complete the picture. \\
Fitting an interaction is a tedious task and there exist much less Gogny than Skyrme interactions on the market however. Even less are applicable to astrophysics. Most of the forces available have indeed a root mean square over masses enclosed between $2-6$ MeV. \\
Motivated by a relatively recent extension of the Gogny force \cite{does} including a third gaussian in the central term, recents results \cite{D3G3} have lead us to think we could build a parametrization fulfilling previously mentioned requirements. \\
I will present the freshly obtained \cite{D3} Gogny-Hartree-Fock-Bogoliubov nuclear mass model by means of a systematic fitting protocole over infinite nuclear matter and nuclear masses similar to the one adopted for D1M \cite{D1M}, with a rms as low as 800 keV, and show the improvements made compared to other Gogny forces. I will also discuss where we found room for future steps towards fitting procedures as well as what we intend to do next to lower even further the rms.

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\bibitem{D3} L.~Batail, S.~Goriely, S.~Peru, S.~Hilaire, \textit{to be submitted}
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**Auteur principal:** BATAIL, Lysandra (Institut d'Astronomie et d'Astrophysique - Université libre de Bruxelles)

**Co-auteurs:** Prof. GORIELY, Stéphane (Université Libre de Bruxelles); Prof. HILAIRE, Stéphane (CEA Bruyères-le-Châtel); PERU, Sophie (CEA)

**Orateur:** BATAIL, Lysandra (Institut d'Astronomie et d'Astrophysique - Université libre de Bruxelles)

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