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A novel numerical library for neutrino-matter interaction rates in binary neutron star mergers

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GW170817 marked the first outstanding detection of a gravitational-wave signal generated by the coalescence of a binary neutron star (BNS) system. The successful follow-up campaign carried out by electromagnetic facilities has confirmed the remarkable scientific potential of such events in the context of newborn multi-messenger astrophysics. In this respect, reliable theoretical modeling of the coalescence is crucial to avoid systematic errors when interpreting observations. Among the important physical effects to be considered, the interplay between neutrinos and nuclear matter can generate distinct fingerprints on the coalescence, such as affecting the stability of the remnant in the merger aftermath or defining the initial conditions from which the rapid neutron capture process in the ejecta takes on.

To this end, we present "bns_nurates", a novel numerical library written to compute neutrino-matter interaction rates in BNS context. "bns_nurates"is designed to account for different kinds of nuclear physics effects on the interaction rates. As an example of application, we compare the importance of different reaction rates for typical conditions realized during the post-merger phase. Such a study can help to select which relevant reactions need to be included to correctly predict the impact of neutrinos on the system.

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