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General predictions of neutron star properties using unified relativistic mean-field equations of state

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In our work we present general predictions for the static observables of neutron stars (NSs) under the hypothesis of a purely nucleonic composition of the ultra-dense baryonic matter, using Bayesian inference on a very large parameter space conditioned by both astrophysical and nuclear physics constraints.

The equation of states are obtained using a unified approach of the NS core and inner crust within a fully covariant treatment based on a relativistic mean-field Lagrangian density with density dependent couplings. The posterior distributions are well compatible with the ones obtained by semi-agnostic meta-modelling techniques based on non-relativistic functionals, that span a similar portion of the parameter space in terms of nuclear matter parameters, and we confirm that the hypothesis of a purely nucleonic composition is compatible with all the present observations.

We additionally show that present observations do not exclude the existence of very massive neutron stars with mass compatible with the lighter partner of the gravitational event GW190814 measured by the LIGO-Virgo collaboration.
Some selected representative models, that respect well all the constraints taken into account in this study, and approximately cover the residual uncertainty in our posterior distributions, will be uploaded in the CompOSE database for use by the community.

session

H. Equation of State and Neutron Stars

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