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Bayesian Inference of the Neutron Star Equation of State from Astrophysical Observations

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Astrophysical observations of neutron stars (NS) allow us to study the physics of matter at extreme conditions which are beyond the scope of any terrestrial experiments. In this work, we perform a Bayesian analysis putting together the available knowledge from the nuclear physics experiments,
observations of different x-ray sources and the gravitational wave event GW170817 to constrain the equation of state of supranuclear matter.
In particular, we employ a relativistic mean field model to calculate the saturation properties of nuclear matter i.e. the symmetry energy and its slope parameter, the incompressibilty, the effective mass of nucleon, the binding energy per nucleon and the saturation density. Then, we investigate if it is possible to reconcile the inferred values of those quantities from observational data with the values obtained from nuclear experiments and compute a joint posterior of these quantities incorporating all the available knowledge. We also study the possibility of the existence of strange matter inside the NS in the form of hyperons or a phase transition into a strange quark star.

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