ID de Contribution: **27** Type: **Non spécifié**

Can we decipher the composition of the core of a neutron star?

Recent development in multi-messenger astronomy through gravitational waves (LIGO/VIRGO) or X-ray spectra (NICER) provide new constraints to the theories of nuclear physics, where an absolute energy density functional from ab-initio modelling is still not available.
General relativity guarantees that there is a unique one-to-one correspondence between static observables of neutron stars such as mass-radius relation or tidal deformability and equation of state (EoS) of beta equilibrated matter. However, these static properties are not enough to predict the composition of the interiors of neutron stars. In a novel meta-model approach this problem is demonstrated through a simple analytical method, which is further reinforced by a Bayesian analysis. A possible remedy is also suggested which can be realized by information on symmetric matter at high densities.

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