ID de Contribution: **16** Type: **Non spécifié**

The effect of the energy functional on the pasta-phase properties of catalysed neutron stars

Nuclear pasta, that is, an inhomogeneous distribution of nuclear matter characterised by non-spherical clustered structures, is expected to occur in a narrow spatial region at the bottom of the inner crust of neutron stars, but the width of the pasta layer is strongly model-dependent. In the framework of a compressible liquid-drop model, we use Bayesian inference to analyze the constraints on the sub-saturation energy functional and surface tension imposed by both ab-initio chiral perturbation theory calculations and experimental measurements of nuclear masses. The posterior models are used to obtain general predictions for the crust-pasta and pasta-core transition with controlled uncertainties. A correlation study allows extracting the most influential parameters for the calculation of the pasta phases. The important role of high-order empirical parameters and the surface tension is underlined.

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