Contribution ID: **218** Type: **Poster**

# Nuclear pasta in neutron stars

*Monday 16 September 2024 10:51 (1 minute)*

Theory has long predicted that a dense mantle consisting of exotic nuclear structures known as “nuclear pasta”exists between the crust and the core of a neutron star. Studying this possible phase of dense matter is important since its transport and mechanical properties differ markedly from those of the crust. Different types of pasta would thus leave an imprint on many observable aspects of neutron stars, from their magnetothermal evolution to the gravitational waves they emit. In this contribution, I study the emergence of pasta phases with parameterizations of a nuclear energy density functional that were accurately calibrated to both (I) thousands of experimental data points on nuclear structure and (ii) state-of-the-art ab initio predictions for dense matter. I will compare different levels of approximations: starting from a semi-classical approach in one dimension up to fully quantum-mechanical simulations in three dimensions. In particular, I will show how the inclusion of quantum effects in the modeling impacts the formation of nuclear pasta.

[1] N. N. Shchechilin, N. Chamel, J. M. Pearson, Physical Review C, 108, 025805 (2023)

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**Session Classification:** Poster Flashes