Contribution ID: **6** Type: **not specified**

Neutron stars as a laboratory for particle and nuclear physics

Friday, 3 May 2024 12:10 (20 minutes)

I will review recent progress in the model-independent constraining of the properties of neutron-star matter using ab-initio tools from theoretical particle and nuclear physics. In particular, I will discuss results from a new study employing Bayesian inference methods and taking input from both electromagnetic and gravitational-wave observations, which point to the rapid conformalization of matter close to the central densities of the most massive stable stars. These results point towards the likely existence of quark-matter cores inside massive neutron stars, the likelihood of which we estimate to be around 80-90%.

In addition, I will briefly discuss, how a combination of ab-initio microscopic calculations and the eventual recording of a postmerger gravitational-wave signal can provide insights to the off-equilibrium dynamics of dense QCD matter and confirm the dynamical creation of deconfined matter during binary neutron-star mergers.

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Session Classification: Talks