Contribution ID: **26** Type: **Poster**

Constraining neutron star equation of state from astrophysics, high and low energy nuclear physics

Monday, 21 May 2018 18:30 (0 minutes)

A novel equation of state with the surface tension induced by particles' interactions was generalized to describe the properties of the neutron stars. In this equation the interaction between particles occurs via the hard core repulsion by taking into account the proper volumes of particles. Recently, this model was successfully applied to the description of the properties of nuclear and hadron matter created in collisions of nucleons.

The new approach is free of causality problems and is fully thermodynamically consistent, which enables us to use it for the investigation of the strongly interacting matter phase-diagram properties in a wide range of temperatures and baryon densities, including neutron stars. The considered model with a small number of parameters, fully determined according to the experimental constraints, reproduces very well all the known properties of normal nuclear matter, provides a high quality description of the proton flow constraints, hadron multiplicities created during the nuclear-nuclear collision experiments and equally is consistent with astrophysical data coming from neutron star observations. Accordingly, we found parameter values that are in good agreement with the same ones obtained from the nuclear–nuclear collision data analysis.

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Session Classification: Poster Session