ID de Contribution: **118** Type: **Poster**

Tidal Deformability of Quark Stars with Repulsive Interactions

mercredi 15 septembre 2021 16:00 (1 minute)

The QCD phase diagram at low temperature and high chemical potential still remains poorly understood. Several calculations suggest that, in this region, matter deconfines into a phase of quarks and gluons (known as cold QGP or quark matter), which can exist in the core of neutron stars. It is even possible that neutron stars are formed entirely by cold QGP. Usually we model neutron stars with the help of phenomenological models of the equation of state (EoS) that can describe matter in this region. With a given EoS we calculate quantities that can be compared with experimental data.

In view of the rapid experimental progress in the field, we update a model already used in a previous work called MFTQCD. It assumes that the gluon field can be decomposed into gluons with high and low momentum. The former can be treated with a mean field approximation and the latter yield expectation values which are related to the gluon condensates. We calculate the mass-radius diagram, we obtain the tidal deformability and compare the results with the new astrophysical observations. We conclude that our model remains compatible with the experimental data. However, the parameter window is now narrower.

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Classification de Session: Poster