Contribution ID: **755** Type: **Oral**

Phenomenological QCD equations of state for neutron star mergers and supernovae

Wednesday 8 February 2017 17:30 (20 minutes)

We study neutron star matter equations of state at finite temperature for neutron star mergers and supernovae, including not only thermal quark fluctuations but also the Nambu-Goldstone modes. Our description is based on 3-window modeling in which nuclear matter at nB < 2n0 (nB:baryon density, n_0:saturation density) is smoothly connected to strongly correlated quark matter at nB > 5n0. Our quark matter at zero temperature is in the color-flavor-locked (CFL) phase with the gap of 100-200 MeV. The latter is significantly constrained by the two-solar mass constraint. Applying a schematic quark model for the nB > 5n0 domain, we constrain the possible range of the model parameters, and then use them to calculate various quantities of NG modes. Our predictions differ from the weak coupling results for the CFL because we are treating the strongly correlated domain. The resulting equations of state are like neither gapless quark nor nuclear equations of state, due to different temperature dependence of thermal contributions. The difference affects the pattern of gravitational wave signals.

Preferred Track

Baryon-Rich QCD Matter and Astrophysics

Collaboration

Not applicable

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Session Classification: Parallel Session 8.1: Baryon-Rich QCD Matter and Astrophysics (III)

Track Classification: Baryon-Rich QCD Matter and Astrophysics