QUARK MATTER 2015
Sep. 27 – Oct. 3, 2015 Kobe, Japan

Contribution ID: **665** Type: **Poster**

Speed of Sound at Chiral Phase Transition

Tuesday, 29 September 2015 16:30 (2 hours)

The speed of sound $c_s^2 = (\partial P/\partial \varepsilon)_{\text{adiabatic}}$ plays an important role in the hydrodynamic evolution of the hot and dense matter.

We calculate the behavior of c_s^2 in a chiral quark-meson model at finite temperature and baryon density and discuss possible consequences of the chiral phase transition which belongs to 3d $O(4)$ universality class. By comparing the results from the no-sea mean-field approximation, the mean field approximation with fermion vacuum polarization and the case where fluctuations are fully incorporated via functional renormalization group (FRG) approach, we show that the chiral phase transition does not produce a minimum in c_s^2.

Our result may imply that such minimum of c_s^2 observed in lattice QCD at finite temperature is entirely attributed to the deconfinement phenomenon.

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Session Classification: Poster Session

Track Classification: Collective Dynamics