Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Bag Model QCD Phase Diagram with 2-Loop Corrections and Finite Mass[1] GRANT MATHEWS, MAYUKH GANGOPADHYAY, POCAHONTAS OLSON, University of Notre Dame — We summarize the derivation of the finite temperature, finite chemical potential thermodynamic potential in the bag model for QCD that includes a finite s-quark masse in the Feynman diagram contributions for both zero-order and two-loop corrections to the quark interaction. This is desired for computations of the equation of state in the early universe, supernovae, neutron stars, and heavy-ion collisions. The 2-loop contributions are normally divergent and become even more difficult in the limit of finite quark masses and finite chemical potential. We introduce various means to interpolate between the low and high chemical potential limits and determine the equation of state for the two-loop corrections for arbitrary chemical potential, temperature and quark mass. We compute the QCD phase diagram and show that the two-loop corrections decrease the pressure of the quark-gluon plasma and therefore increase the critical temperature and chemical potential of the phase transition. This makes it less likely that a quark-hadron phase transition occurs in neutron stars or supernovae. We also show that the correction for finite s-quark mass in the two-loop correction serves to decrease the critical temperature for the quark-hadron phase transition in the early universe.

[1]Work at the University of Notre Dame is supported by the U.S. Department of Energy under Nuclear Theory Grant DE-FG02-95-ER40934.

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Date submitted: 14 Jan 2020 Electronic form version 1.4