Contribution ID: **698** Type: **Oral**

Path-Integral Monte Carlo Study of the Magnetic Component of Quark-Gluon Plasma At and Above T_c

Wednesday 8 February 2017 11:00 (20 minutes)

Magnetic monopoles are suggested to play an important role in strongly coupled quark-gluon plasma (sQGP) near the deconfinement temperature. Lattice studies show that near the confinement temperature, T_c, quark-gluon plasma (QGP) contains both electric and magnetic quasiparticles. Further studies of the behavior of these quasiparticles at and above T_c, such as those by Liao and Shuryak (2006-2009) and D'Elia and D'Alessandro (2007-2009), found that the magnetic component of QGP forms a liquid, and that the magnetic monopoles form a Bose-Einstein condensate as the temperature approaches the critical temperature, creating the dual-superconductor proposed as a mechanism for confinement.

In this work, we conduct path-integral Monte Carlo (PIMC) simulations of magnetic monopoles, in order to study their behavior at temperatures at and above the confinement temperature. First, we sought to replicate the lattice results of D'Alessandro, D'Elia, and Shuryak (2009) through the study of the permutation cycles of one- and two-component plasmas of bosons interacting with a Coulomb potential. We found for the two-component plasma, as they did on the lattice, that as the system approaches T_c from above the exponential suppression of permutation cycles of these bosons decreases before disappearing at T_c, indicating a phase transition.

We then study thermodynamics and physical distribution of magnetic monopoles, using the densities and coupling strengths given by D'Alessandro and D'Elia (2007); and Liao and Shuryak (2009). At low temperatures, in addition to the formation of the condensate, we see formation of "droplets"of the magnetic charges at strong coupling. This suggesting that the monopoles are indeed forming a liquid, as seen by Liao and Shuryak in their classical molecular dynamics simulations. At low temperatures and large couplings, there are also signs of crystallization in this system, an interesting analog to systems of extremely high density, such as helium white dwarf stars. We then simulate the system at higher temperatures —along lower densities and strong coupling —and see the breakup of these drops of monopole "liquid."Finally, we draw conclusions about the contribution of the monopoles to the overall thermodynamics of the QGP above the confinement temperature.

Preferred Track

New Theoretical Developments

Collaboration

Not applicable

Author: RAMAMURTI, Adith (Stony Brook University)

Presenter: RAMAMURTI, Adith (Stony Brook University)

Session Classification: Parallel Session 6.3: New Theoretical Developments (II)