

**Stony Brook University  
The Graduate School**

**Doctoral Defense Announcement**

**Abstract**

Classical strongly coupled quark-gluon plasma

By

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In the first part of this thesis, we focus on the equilibrium properties of the  $SU(N)$  classical quark-gluon plasma (cQGP). We define the partition function of the cQGP through three expansions: A low density expansion, a cumulant expansion, and a high temperature expansion or loop expansion. We derive the equation of state of the cQGP and compare it to the  $SU(2)$  and  $SU(3)$  lattice data.

In the second part of the thesis, we address the non-equilibrium issues of the  $SU(2)$  cQGP. We derive generalized relations for the multiple color structure factors and compare them to results from molecular dynamics simulation. We use the classical Liouville equations to derive non-perturbative expressions for transport coefficients, e.g, the viscosity and diffusion constant.

In the third part of the thesis, we address the issue of the energy loss of heavy jet quarks in the  $SU(2)$  cQGP. We compare our results to molecular dynamics simulation results at intermediate and strong Coulomb coupling.

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