

A light-cone wavefunction approach to open heavy flavor dynamics in a QGP

Tuesday, 28 July 2009 14:00 (25 minutes)

We calculate the charm and beauty parton distribution functions and fragmentation functions for open heavy mesons in vacuum using their operator definitions in factorized perturbative QCD and find leading corrections that arise from the structure of the final-state hadrons. Using thermal potentials calculated on the lattice we demonstrate the existence of open heavy flavor bound state solutions in the QGP in the vicinity of the critical temperature and provide first results for the in-medium modification of the heavy quark distribution and decay probabilities for mesons in equilibrium with a thermal plasma. In an improved perturbative QCD description of heavy flavor dynamics in the thermal medium we combine D and B meson formation and dissociation with parton-level charm and beauty quark quenching to obtain predictions for the heavy meson and non-photonic electron suppression in Cu+Cu and Pb+Pb collisions at RHIC and the LHC, respectively.

Summary

The early production of heavy quarks makes them some of the most important probes of the QGP formed in relativistic heavy ion collisions. Furthermore, direct measurements of the spectra of charm and beauty hadrons will soon become available with the vertex detector upgrades at RHIC, and at the LHC. In this talk, I will discuss our results for the open charm and beauty spectra observed in heavy ion collisions.

It is well known that suppression of the non-photonic electrons from open heavy mesons observed at RHIC can not be explained by purely partonic energy loss of the heavy quarks. It was shown by Adil and Vitev, that the non-perturbative process of fragmentation inside the thermal medium and subsequent dissociation can lead to a larger suppression of the non-photonic electrons, giving better agreement with data. We perform a detailed calculation of heavy meson suppression, combining the partonic level energy loss with the dissociation mechanism, and include systematically all known cold nuclear matter effects. We also consider the modifications of the fragmentation functions and the parton distribution functions for open heavy mesons in equilibrium with the medium, and see how this affects the suppression.

Looking ahead, we give predictions for the differential distributions and multiplicities of charm and beauty hadrons at the LHC.

Author: SHARMA, Rishi (LANL)

Co-authors: ZHANG, Benwei (LANL); VITEV, Ivan (LANL)

Presenter: SHARMA, Rishi (LANL)

Session Classification: Heavy Ions I

Track Classification: Heavy Ion Physics/Hot and Dense QCD