Contribution ID: **151** Type: **Poster**

Effects of parton radiative processes on Quark-Gluon Plasma thermalization

Radiative processes and dynamical screening are important for a precise description of the dynamics of relativistic heavy ion collisions. When evolutions from inside-outside and thermal initial conditions are compared, the parton system produced in relativistic heavy ion collisions is found to be able to overcome expansion and move toward thermalization via parton collisions. Scaling behaviors show up in both the pressure anisotropy and the energy density evolutions. In particular, the pressure anisotropy evolution shows an approximate coupling constant scaling when radiative processes are included. It approaches an asymptotic time evolution on a time scale of 1 to 2 fm/c. The energy density evolution approaches an asymptotic time evolution that decreases slower than the ideal hydro evolution. These observations indicate that partial thermalization can be achieved and viscosity is important for the evolution during the early longitudinal expansion phase of a relativistic heavy ion collision.

Radiative processes are the driving force behind gluon chemical equilibration. The effects of these processes, or of chemical equilibration, on kinetic equilibration can be studied by comparing the evolution with only the elastic process to that including radiative processes. When the initial condition is close to chemical equilibrium, the opening up of the inelastic channels leads to more kinetic equilibration. If the initial condition is highly undersaturated, the additional production of particles quickly leads to smaller cross sections that counteract the increase in the particle number. Then kinetic equilibration is less sensitive to whether there are radiative processes. On the other hand, kinetic equilibration also affects chemical equilibration. As expected, when there are only elastic processes, the system goes farther and farther away from chemical equilibrium. It is interesting to see that systems with the same initial fugacity but different initial pressure anisotropies have different early fugacity evolutions.

In addition to the interplay between chemical equilibration and kinetic equilibration, the pressure anisotropy difference evolution for systems starting from different initial pressure anisotropies is studied to gain better insight into the approach to the asymptotic evolution. The difference evolution is found to follow an exponential proper time dependence after a short period of time. In the case that includes radiative processes, the larger the coupling constant or the larger the initial energy density, the faster the difference decreases. The evolution curves for different coupling constants and initial energy densities appear to come from the same point. Pressure anisotropy evolutions from thermal initial conditions and Color Glass Condensate motivated initial conditions are compared to study the effects of initial particle momentum distribution. Radiative processes are again shown to make a big difference in system evolution. When only the gluon elastic process is included, kinetic equilibration is sensitive to the initial momentum distribution. If radiative processes are included, the pressure anisotropy evolution is robust against changes in the initial momentum distribution.

Reference:
Parton radiative processes and pressure isotropization in relativistic heavy ion collisions, Bin Zhang, Warner A. Wortman, Phys. Lett. B 693, 24 (2010).

Primary author: ZHANG, Bin (Arkansas State University)

Co-author: WORTMAN, Warner (Arkansas State University)

Presenter: ZHANG, Bin (Arkansas State University)

Track Classification: Pre-equilibrium and initial state physics