

Multiple scattering in nuclear matter

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The larger goal of this project is the description of multiple scattering in nuclei by means of perturbative quantum chromodynamics (QCD). This is strictly possible only for some simple processes, like deep-inelastic scattering on nuclei, the Drell-Yan process in nuclei, etc. On the other hand many results of hard probes in nucleus-nucleus collisions at the Relativistic Heavy Ion Collider (RHIC), lie beyond a strict perturbative description, even though they involve large momentum transfer. They can only be explained by modeling certain aspects of the collision. Hard probes in nuclear collisions at high energies, i.e. hadrons or jets with energies of several GeV and above, are important probes for the quark gluon plasma phase created in these collisions, and a better understanding of their propagation through hot nuclear matter is of great importance.

In the past year we have worked on a phenomenological front end to simulate hard probes in nuclear collisions at high energy. This software package propagates either single quarks and gluons or correlated pairs of quarks, gluons and photons through a background fireball, which is treated as a flexible input to the simulation. Several models of energy loss and several options for fragmenting quarks and gluons into hadrons have been implemented so far. Modules to calculate standard observables in heavy ion physics, e.g. single and di-hadron nuclear suppression factors, di-hadron correlation functions, azimuthal asymmetry coefficients v_2 , etc., have been included.

This software package will be used for systematic studies of hard probes, some of which are reported on elsewhere. We are particularly interested in comparisons between different energy loss models, consistency checks between them, and systematic studies of how we can learn about the underlying fireball by using hard probes.