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Short path length corrections to pQCD phenomenological energy loss models in a QGP

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The standard model of particle physics has been used to successfully describe observables from particle collisions at high energies in colliders such as the LHC and RHIC. In the last twenty years evidence for the formation of a substance known as Quark Gluon Plasma (QGP), has been found in heavy-ion collisions (collisions of atoms with a large number of nucleons). This substance probes the most interesting and complicated sector of the standard model - Quantum Chromodynamics (QCD). The QGP is a nearly ideal fluid which existed around 20μs after the Big Bang, and is made up of the freely interacting fundamental degrees of freedom in QCD - quarks and gluons. Phenomenological perturbative QCD (pQCD) models describing QGP formation involve many moving parts: a model for the non-perturbative, fluctuating, initial conditions of the collision; a hydrodynamics simulation of the fluid; a perturbative QCD model for both radiative and elastic energy loss; and a model for the hadronization of quarks and gluons into final state hadrons. With all of these inputs and theoretical uncertainties, the success of predictions of various phenomenological models is astounding. An open and fascinating question in this field, is how big does a collision system have to be before QGP is formed? In particular it is not known whether there is QGP formation in systems such as proton + heavy-ion ($p + A$) or even high-multiplicity proton+proton ($p + p$) collisions. The current theoretical tools are often ill-equipped to deal with small systems; and the validity of thermal field theory, and hydrodynamics in these small systems is not known. In this talk I will introduce some phenomenological models which have been used to successfully describe observables related to the formation of QGP in heavy ion collisions; as well as talk about our original work being done to allow existing pQCD energy loss models (WHDG, DGLV) to be used for predictions related to QGP formation in smaller systems ($p + p$ and $p + A$) collisions.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

Primary author: FARADAY, Coleridge (University of Cape Town)

Co-author: HOROWITZ, William (University of Cape Town)

Presenter: FARADAY, Coleridge (University of Cape Town)

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