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The 113rd HENPIC seminar by Dr. Jasmine Brewer, Massachusetts Institute of Technology (MIT), July 16th, 2020, Thursday, 10:30 am (Beijing time)

Talk title: Equilibration and jets in the quark–gluon plasma

Speaker : Dr. Jasmine Brewer, Massachusetts Institute of Technology (MIT)

Abstract:
Heavy-ion collision experiments provide a unique window into the structure of the high-temperature phase of QCD, the quark–gluon plasma. In this talk we will address aspects of two conceptual approaches to studying the quark–gluon plasma: the emergence of hydrodynamic behavior and the modification of jets.

First, we describe a new scenario characterizing the transition of the quark-gluon plasma from a highly non-equilibrium state at early times toward a fluid described by hydrodynamics at late times. In this scenario, the bulk evolution is governed by a set of slow modes that are "pre-hydrodynamic" in the sense that they are initially distinct from, but evolve continuously into, hydrodynamic modes in hydrodynamic limit. We explicitly identify the pre-hydrodynamic modes for a kinetic description of weakly-coupled Bjorken expanding plasma and demonstrate in the relaxation-time approximation that the full kinetic theory evolution is indeed dominated by these modes.

Second, we discuss a data-driven method to estimate the separate energy loss and modification of quark- and gluon-initiated jets in the quark–gluon plasma using a statistical technique called topic modeling. Assuming that jet distributions are a mixture of underlying "quark-like" and "gluon-like" distributions, we show how to extract quark and gluon jet fractions and constituent multiplicity distributions as a function of the jet transverse momentum. These results suggest the potential for an experimental determination of quark and gluon jet modifications.

Profile: Jasmine Brewer is currently a Ph.D. candidate in physics at MIT and will be starting in the fall as a fellow at CERN. Her primary research interests are in jet modification in heavy-ion collisions and the far-from-equilibrium evolution of the quark-gluon plasma.