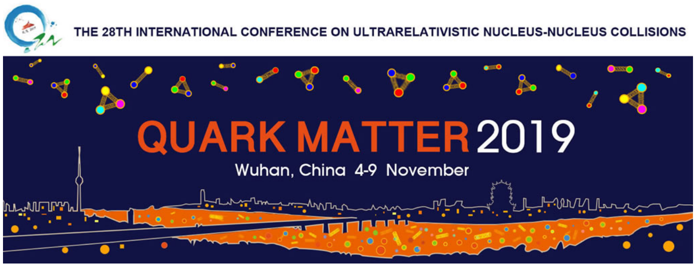

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An Effective Theory of Quarkonia in QCD Matter

Wednesday, 6 November 2019 09:00 (20 minutes)

The problem of quarkonium production in heavy ion collisions presents a set of unique theoretical challenges –from the relevant production mechanism of J/ψs and Υs
to the relative significance of distinct cold and hot nuclear matter effects in the observed attenuation of quarkonia. In the well-defined leading power factorization limit of non-relativistic Quantum Chromodynamics (NRQCD) we show conclusively that in spite of certain similarities in the suppression of J/ψs of moderate transverse momenta to the one of light/heavy hadrons, the familiar parton energy loss picture is distinctly incompatible with the hierarchy of the attenuation of ground and excited quarkonium states. With this in mind, for heavy quarkonia of moderate energy we generalize the relevant successful theory NRQCD to include interactions in nuclear matter. The new resulting theory, NRQCD with Glauber gluons, provides for the first time a universal microscopic description of the interaction of heavy quarkonia with a strongly interacting medium, consistently applicable to a range of phases, such as cold nuclear matter, dense hadron gas, and quark-gluon plasma. The effective field theory we present in this work is derived from first principles and is an important step forward in understanding the common trends in proton-nucleus and nucleus-nucleus data on quarkonium suppression. We explicitly show the lowest order (LO) and next-to-leading order (NLO) interaction terms in the Lagrangian and discuss the connection of the LO result to existing phenomenology.

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