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Radiative energy loss in absorptive medium

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Understanding the energy loss of strongly interacting particles is of utmost importance for studying the quark-gluon plasma (QGP). This very hot and dense state of matter is created during heavy-ion collisions, like the ones performed at the LHC. As the lifetime of the QGP is very brief, special probes are necessary to study it. One of them consists in focusing on the energy loss of energetic quarks or gluons (so-called partons) created in the early stages of the collision. These partons go through the QGP and are sensitive to all its development. One can then compare the energy spectrum of this kind of particles after going through the QGP or after going through usual nuclei and learn features of the QGP by comparison. For this it is important to master theoretically the energy loss of these partons.
A particle can loose energy either by collisional processes (diffusion in the medium) or by radiative mechanisms (bremsstrahlung). The emission of a gluon takes a certain amount of time called the formation time. In the medium, this time can be longer than the mean free path of the particle leading to the LPM effect and a modification of the emission spectrum. But what if during its formation the gluon emits other gluons in turn. One phenomenological way to deal with this effect is to associate a damping rate to the first emitted gluon, and then investigate the consequences on its parent parton energy loss.
In this presentation, we use the formalism developed in [1] to study the in-medium radiation by energetic quarks or gluons. In this formalism the propagation of a parton and its elastic scatterings with the medium is driven by a two-point correlator of the gluon field in the medium. We examine the modification of the two-point correlator for collisions that are accompanied by bremsstrahlung gluons that are sufficiently soft so as to be formed before the next interaction, and study whether this leads to a damping scenario.
[1] Blaizot et al, JHEP01(2013)143

Experimental Collaboration

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