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Color Coherence Effects in Dipole-Quark Scattering in the Soft Limit

Color coherence plays a crucial role in the description of jet evolution in vacuum. Stimulated gluon emission suffered by energetic jets traversing deconfined QCD matter is also affected by color coherence effects. Through multiple soft scatterings with the medium constituents, an antenna will lose its color correlation, causing its legs to behave as independent emitters after the so-called decoherence time. In this work we provide the first computation of the properties of the recoils produced as a result of these soft scatterings between a color coherent dipole and the medium constituents.

Our findings reveal that the angular phase-space of these soft recoils is strongly restricted by the opening angle of the dipole itself due to quantum interference effects. In this long wavelength limit, one can effectively consider that interactions take place with each of the legs of the dipole separately, provided that the angular constraints dictated by the corresponding color flow topologies are respected. This is in complete analogy with the case of soft gluon emission in vacuum, where the recoil quark plays the role of the emitted gluon. As a direct phenomenological application we estimate the collisional energy loss rate of a colored antenna. Importantly, these results indicate the way in which color coherence effects can be implemented in jet quenching models that account for the recoils from elastic scatterings, improving in this way our description of medium response physics.

Category

Theory

Collaboration

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