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Angular Structure of Jet Quenching within a Hybrid Strong/Weak Coupling Model

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Within the context of a hybrid strong/weak coupling model of jet quenching, we study the modification of the angular distribution of the energy within jets in heavy ion collisions, as partons within jet showers lose energy and get kicked as they traverse the strongly coupled plasma produced in the collision. To describe the dynamics transverse to the jet axis, we add the effects of transverse momentum broadening into our hybrid construction, introducing a parameter $K \equiv \hat{q}/T^3$ that governs its magnitude. We show that, because of the quenching of the energy of partons within a jet, even when $K \neq 0$ the jets that survive with some specified energy in the final state are narrower than jets with that energy in proton-proton collisions. For this reason, many standard observables are rather insensitive to K.
We propose a new differential jet shape ratio observable in which the effects of transverse momentum broadening are apparent.
We also analyze the response of the medium to the passage of the jet through it, noting that the momentum lost by the jet appears as the momentum of a wake in the medium. After freezeout this wake becomes soft particles with a broad angular distribution but with net momentum in the jet direction, meaning that the wake contributes to what is reconstructed as a jet. This effect must therefore be included in any description of the angular structure of the soft component of a jet.
We show that the particles coming from the response of the medium to the momentum and energy deposited in it leads to a correlation between the momentum of soft particles well separated from the jet in angle with the direction of the jet momentum, and find qualitative but not quantitative agreement with experimental data on observables designed to extract such a correlation.
More generally, by confronting the results that we obtain upon introducing transverse momentum broadening and the response of the medium to the jet with available jet data, we highlight the importance of these processes for understanding the internal, soft, angular structure of high energy jets.

Preferred Track

Jets and High pT Hadrons

Collaboration

Not applicable

Primary author: RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US))

Presenter: RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US))

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