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The wake of jets from linearized hydrodynamics

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Recently, jet substructure observables have been widely used in the study of jets. Some observables are sensitive to the wide angle soft particles within the jet, for example, the Lund plane distribution with different jet radii and soft drop parameters. As the jet loses energy and momentum during its evolution inside the quark-gluon plasma (QGP), the "lost" energy and momentum is deposited in the medium, evolves therein —the wake of the jet. This wake ultimately hadronizes into particles whose net momentum must be correlated with the jet direction, since it corresponds to the momentum lost by the jet. This means that when a jet reconstruction algorithm is then used to find the jet, some of the particles originating from the wake must end up being counted as a part of the jet. Since these particles are generally soft, and are spread over a wide angle with respect to the jet axis, they can significantly modify those jet substructure observables that are sensitive to the soft physics and/or to physics at wide angles. To understand the predictions of any model of jet quenching for such observables, it is mandatory to quantify the dynamics of the back-reaction of the medium to the jet, namely the wake of the jet. Understanding of the back-reaction will also deepen our understanding of the collective dynamics.

In this talk, we will report progress toward addressing this question by treating the energy and momentum loss as a perturbation on the background of a Bjorken flow. By working to linear order in the perturbation and solving the resulting evolution equations numerically in momentum space, we study how the wake evolves within the hydrodynamically evolving droplet of QGP and explore the dependence of the dynamics of the wake on the viscosity of the QGP and model uncertainties. Via this study, we upgrade the previous numerical implementation of the jet wake in the hybrid model, in particular for the component of the wake that yields particles with transverse momenta of a few GeV after hadronization. Further we will assess the phenomenological impact of the improved wake treatment on a range of jet observables.

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