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Sensitivity of jet observables to the presence of quasi-particles in the QGP

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Even though QGP, when looked at on length scales of order the inverse of its temperature, is best described as a strongly coupled liquid, when it is observed at sufficiently short length scales or probed at sufficiently high exchanged-momentum, asymptotic freedom predicts the presence of quark-like and gluon-like quasi-particles. High energy partons (e.g. those in jet showers) traversing the QGP, capable of triggering these high-momentum exchanges with the medium constituents, have the potential to reveal the presence of such quasi-particles.

In this work we present an implementation of this physics within the hybrid strong/weak coupling model in which, prior to this work, only the non-perturbative aspects of parton energy loss had been accounted for. Interaction with the quasi-particles results in elastic Moliere scatterings, leading to deflection of the direction of the jet parton that induced the process as well as the excitation of partons from the thermal medium that recoil after being kicked. Throughout the in-medium evolution, the system of jet partons and recoils, which might further re-scatter, inject energy and momentum into the QGP, producing wakes. We analyze a variety of setups, such as boson-jet systems, c-cbar systems, as well as dijet systems, at different jet transverse momenta and reconstruction radius, R. We will discuss the effect of Moliere scatterings on acoplanarity distributions, as well as on some of the most widely used groomed and ungroomed jet substructure observables.

Given the large impact of the wakes generated by the hydrodynamic response of the medium on jet observables, as well as the presence of selection biases, finding unique signatures of the presence of the elastic scatterings is a challenging task. We will present some strategies that may be followed with a view toward enhancing and isolating the effect under consideration. These include the application of momentum cuts, differential studies of the angular distribution of particles around the jet, and, most revealing, the properties of the subjets (jets within jets) distributions. A comparison against the effect of a purely Gaussian, Brownian-like transverse momentum broadening will also be presented.

Primary authors: Dr PABLOS, Daniel (University of Bergen); HULCHER, Zach (Stanford University); RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US))

Presenter: HULCHER, Zach (Stanford University)

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