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How many observables are necessary to constrain light parton transport properties?

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Interactions between hard partons and the quark-gluon plasma range from frequent soft interactions to rare hard interactions. While it is reasonable that hard interactions can be described perturbatively, soft interactions likely suffer from significant non-perturbative effects. Since the effect of the soft interactions can be encoded into parton transport coefficients, these non-perturbative effects can in principle be quantified by extracting the drag and diffusion of light partons from heavy ion measurements.

In this work, we perform a proof of principle calculation to determine to what extent the drag and diffusion of light partons can be constrained from jet measurements. We implement this study in the JETSCAPE framework [1] using a hard-soft factorized parton energy loss model derived in the weakly-coupled limit [2]. We first calculate a set of jet observables using known drag and diffusion coefficients. By then applying a Bayesian analysis on these observables, we determine which observables can best constrain the light parton transport coefficients. We use this closures test to understand how adding observables, or reducing uncertainties on specific observables, can improve constraints on the parton's transport coefficients.

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[1] Putschke, J. H., Kauder, K., Khalaj, E., Angerami, A., Bass, S. A., Cao, S., ... & Elfner, H. (2019). The JETSCAPE framework. arXiv preprint arXiv:1903.07706.
[2] Ghiglieri, J., Moore, G. D., & Teaney, D. (2016). Jet-medium interactions at NLO in a weakly-coupled quark-gluon plasma. Journal of High Energy Physics, 2016(3), 95.

Collaboration (if applicable)

Track

Jets and High Momentum Hadrons

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Primary authors: DAI, Tianyu (Duke University); BASS, Steffen A. (Duke University); PAQUET, Jean-Francois (Duke University); TEANEY, Derek (Stony Brook University)

Presenter: DAI, Tianyu (Duke University)

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