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Universality of jet energy loss in the quark-gluon plasma using Bayesian inference

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Experimental data on a wide range of jet observables measured in heavy ion collisions provide a rich picture of the modification of jets as perturbative probes and of the properties of the quark-gluon plasma that is formed in these collisions. However, their interpretation is often limited by the assumptions of specific quenching models, and it remains a challenge to establish model-independent statements about the universality of different jet quenching observables.

In this work, we address this issue by proposing a treatment that is agnostic to the details of the jet-medium interactions and relies only on the universality of quark and gluon quenching in different jet observables. We use Bayesian inference to constrain the parameterisation of the energy loss of quark- and gluon-initiated jets in a data-driven manner. This constraint is primarily performed using the inclusive jet pT spectrum, for which the quark/gluon fraction varies across rapidity. We then predict the observed jet asymmetry in di-jet and boson-jet measurements, providing evidence for the universality of quenching effects.

Furthermore, we examine the extracted Casimir scaling of jet quenching and the role of resolution effects in constraining the early, perturbative jet evolution using these data-driven methods. This study provides a new perspective on the universality of jet quenching in heavy ion collisions, free from the assumptions of specific models.

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