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Investigating scattering rates in Thermal Field Theory beyond the leading log

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Relativistic heavy-ion collisions are reaching temperatures where the quarks and gluons, fundamental constituents of the nucleus, become deconfined and enter a state called the Quark-Gluon plasma (QGP). Its properties are a window into the underlying nature of the strong force under extreme conditions of temperature and pressure, which can be inferred from experimental measurement. Like proton-proton collisions, heavy-ion collisions produce a collimated spray of energetic particles known as a jet. Our understanding of jets in the vacuum setting –such as that in proton-proton collisions –makes them a calibrated probe to study the QGP. Through their exchange of energy and momentum with the QGP, jets probe the microscopic physics describing the QGP itself. Constraining jet-medium transport coefficients, such as their transverse-momentum broadening in the QGP, is a key objective of jet quenching studies in heavy-ion collisions. The transverse-momentum broadening is a moment of the jet-medium scattering rate that will be discussed in this presentation. The jet-medium scattering rate will first be presented using the eikonal forward scattering approximation, followed by the full tree-level scattering rate in thermal field theory. The transverse-momentum broadening coefficient is then computed as a moment of scattering rate. We find significant deviations away from the eikonal result, both in the scattering rate and the transverse-momentum broadening transport coefficient. As these eikonal results have been employed in recent Bayesian constraints on the transverse-momentum broadening of jets in the QGP, we will explore how our results can be used to improve current Bayesian analysis of jet-medium transport coefficients.

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