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Transverse Momentum Broadening and the Jet Quenching Parameter, Redux FRANCESCO D'ERAMO, HONG LIU, KRISHNA RAJAGOPAL, MIT — We use Soft Collinear Effective Theory (SCET) to analyze the transverse momentum broadening, or diffusion in transverse momentum space, of an energetic parton propagating through quark-gluon plasma. Since we neglect the radiation of gluons from the energetic parton, we can only discuss momentum broadening, not parton energy loss. The interaction responsible for momentum broadening in the absence of radiation is that between the energetic (collinear) parton and the Glauber modes of the gluon fields in the medium. We derive the effective Lagrangian for this interaction, and we show that the probability for picking up transverse momentum $k_\perp$ is given by the Fourier transform of the expectation value of two transversely separated light-like path-ordered Wilson lines. This yields a field theoretical definition of the jet quenching parameter $\hat{q}$, and shows that this can be interpreted as a diffusion constant. We close by revisiting the calculation of $\hat{q}$ for the strongly coupled plasma of N=4 SYM theory, showing that previous calculations need some modifications that make them more straightforward and do not change the result.

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