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Thermalization of mini-jets in a quark-gluon plasma

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We complete the physical picture for the evolution of a high-energy jet
propagating through a weakly-coupled quark-gluon plasma
by investigating the thermalization of the soft components of the jet.
We argue that the following scenario should hold:
the leading particle emits a significant number of mini-jets which promptly evolve via
quasi-democratic branchings and thus degrade into a myriad of soft gluons,
with energies of the order of the medium temperature T.
Via elastic collisions with the medium constituents, these soft gluons relax to local thermal equilibrium with the plasma
over a time scale which is considerably shorter than the typical lifetime of the mini-jet.
The thermalized gluons form a tail which lags behind the hard components of the jet.
We support this scenario, first, via parametric arguments and, next, by studying
a simplified kinetic equation, which describes the jet
dynamics in longitudinal phase-space.
We solve the kinetic equation using both (semi-)analytical and numerical methods.
In particular, we obtain the first exact, analytic, solutions to the ultrarelativistic
Fokker-Planck equation in one-dimensional phase-space.
Our results confirm the physical picture aforementioned
and demonstrate the quenching of the jet via multiple branching followed by the
thermalization of the soft gluons in the cascades.

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