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Jet energy loss in heavy ion collisions

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The phenomenon of jet quenching in ultra-relativistic heavy ion collisions reveals the effect of substantial final state interactions that cause QCD jets to lose energy to the quark-gluon plasma (QGP), mainly by induced gluon radiation. In standard analytic approaches to energy loss, jets are approximated by single partons and thus higher-order effects in the strong coupling constant are neglected. This may prove insufficient to reliably extract QGP properties at high pT, where a significant jet suppression was recently reported by the ATLAS collaboration in PbPb collisions at the LHC. In this work we explore higher-order contributions to the inclusive jet spectrum which may be sizable owing to the fact that the probability for a highly virtual parton to split in the medium increases with the jet pT. As the effective number of jet constituents increases, jets are expected to lose more energy than a single color charge. This translates into a logarithmic enhancement of higher-orders in the perturbative series that need to be resummed. As a result we obtain a Sudakov-like suppression factor which we investigate in the leading logarithmic approximation. We note, however, that the phase space for higher-order corrections is mitigated by coherence effects that relate to the fact that, below a characteristic angular scale, the medium does not resolve the inner jet structure. In this case, the jet lose energy coherently as a single color charge, namely, the primary parton.