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Forward di-jet production in dilute-dense collisions

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We propose a factorization formula for the cross section for forward di-jet production in dilute-dense collisions. The new formula is applicable for an arbitrary value of the momentum imbalance of the two jets, k_t. This generalizes the transverse momentum dependent (TMD) factorization formula that has been derived before by Dominguez et al. Their formula is valid only for small values of the transverse momentum of the small-x gluon from the target; it has TMD gluon distributions, but on-shell hard matrix elements. We extend their formula to all ranges of k_t by including off-shell matrix elements. We also add finite N_c corrections. The derivation is done with a standard Feynman diagram technique, and, independently, with a color ordered amplitudes method. The new formula encompasses both, the TMD factorization for small k_t on the order of the saturation scale, and the High Energy Factorization (HEF) for large k_t on the order of the momentum of the jets. The TMD and HEF factorizations can be derived from the Color Glass Condensate (CGC) formula for forward di-jet production in the appropriate limits. We show explicitly the equivalence of HEF and CGC in the dilute target approximation.

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