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Fracture Functions in different kinematic regions and their factorizations

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Fracture functions are parton distributions of a hadron in the presence of an almost collinear particle observed in the final state. They are important ingredients in QCD factorization for processes where a particle is produced diffractively. Different kinds of fracture functions are used for a process in different kinematic regions depending on the scale of the momentum transfer. We take the production of a lepton pair combined with a diffractively produced particle in hadron collisions to discuss this. These fracture functions can be factorized further with twist-2 parton distribution functions and fragmentation functions if there are large energy scales involved. We perform explicit calculations at one loop to illustrate the factorization in the case that the diffractively produced particle is a photon. The complete perturbative coefficients are obtained. Evolution equations for both the integrated and transverse momentum dependent fracture functions are derived from our explicit results. They agree with expectations. These equations can be used for re-summations of large log terms in perturbative expansions. Our results also provide a connection between factorizations with fracture functions and those with twist-2 parton distribution and fragmentation functions.

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