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Breakdown of QCD factorization in hard diffraction

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Factorization of short and long-distance interactions is heavily broken in hard diffractive hadronic collisions. In particular, abelian forward diffractive radiation of direct photons, Drell-Yan dileptons, and gauge bosons Z , W , by a parton is forbidden. Nevertheless, a hadron can diffractively radiate in the forward direction due to a possibility of soft interaction with the spectators. This property of abelian radiation breaks down diffractive factorization resulting in a leading twist dependence on the boson mass, $1/M^2$.

Non-abelian forward diffractive radiation of heavy flavors, diffractive di-jets and diffractive Higgstrahlung are permitted even for an isolated parton. However, interaction with spectators provides the dominant contribution to the cross section. Hard diffraction turns out to be semi-hard, semisoft. It comes from the interplay between large and small distances. Data well confirm the leading twist behavior. Diffractive Higgs production is found to be dominated by coalescence of intrinsic heavy quarks in the proton.

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