Perturbative QCD and multiple scattering in nuclear matter

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Traditional factorization theorems in perturbative QCD describe only a single scattering of partons in high energy collisions of hadrons or nuclei. This is not sufficient if the mean free path of a parton is smaller than the size of the nuclear matter. A rigorous way to treat multiple scattering within a factorized pQCD framework as so-called higher twist corrections has been laid out by J. Qiu and G. Sterman. In the past R.J. Fries has successfully applied this formalism to proton-nucleus collisions. He was the first one to carry out a resummation of higher twist contributions [1]. Renewed interest in this rigorous approach comes from heavy ion physics where pQCD inspired calculations of jet energy loss have turned out to carry a dependence on model assumptions.

R.J. Fries has continued his collaboration with A. Majumder to further develop the higher-twist formalism. Their interest has turned to radiative corrections of multiple scatterings in nuclei. As a first example they studied photon emission in lepton-nucleus (e+A) scattering in the limit of small photon energies and large nuclei. This required the resummation of an arbitrary number of scatterings in the nucleus. A comprehensive paper laying out the formalism in detail will be published [2]. In the future, they plan to generalize their results to gluon emission and to apply the formalism to photon-hadron correlations.

[1] R. J. Fries, Phys. Rev. D **68**, 074013 (2003).
[2] R. J. Fries, Phys. Rev. C **77**, 065209 (2008).