EXPERIMENTAL STUDIES OF FUNDAMENTAL PROCESSES IN QCD COLOR PROPAGATION AND NEUTRALIZATION

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The formation of hadrons has been successfully parameterized for decades via fragmentation functions, but thus far we have a limited understanding of the non-perturbative physics that gives rise to these functions and the connections of these processes to QCD confinement. String models and cluster models of the underlying processes have been constrained by hadron distributions measured in a variety of hard collisions, however, little insight has been gained into the femtometer-scale QCD dynamics at play. With the advent of new particle identi- fication technologies, new information about hadronization can now be obtained from semi-inclusive deep inelastic scattering on nuclei by studying the interac- tions of the struck quark with the nuclear medium, allowing femtometer-scale measurements of the fundamental processes involved to be made for the first time. The modifications of the distributions of the identified hadrons emerging from nu- clei of different sizes reveal a rich variety of spatio-temporal characteristics of the hadronization process, including dependence on flavor, energy, and hadron mass and structure; and in the future, spin degrees of freedom as well. Fixed-target ex- periments at lower energies, pioneered by the HERMES experiment at DESY and now being extended at Jefferson Lab, are laying an important foundation of under- standing of the issues involved. In the future, the ultimate program for exploring the high-energy domain of hadronization will come from the Electron-Ion Col- lider (EIC). In this talk, a description of recent advances will be given, in addition to brief mention of the opportunities in this area at the EIC.