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The Emergence of Hadrons from QCD Color

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The propagation of colored quarks through strongly interacting systems, and their subsequent evolution into color-singlet hadrons, are phenomena that showcase unique facets of Quantum Chromodynamics (QCD). Medium-stimulated gluon bremsstrahlung, a fundamental QCD process, induces broadening of the transverse momentum of the parton, and creates partonic energy loss manifesting itself in experimental observables that are accessible in high energy interactions in hot and cold systems. The formation of hadrons, which is the dynamical enforcement of the QCD confinement principle, is very poorly understood on the basis of fundamental theory, although detailed models such as the Lund string model or cluster hadronization models can generally be tuned to capture the main features of hadronic final states. With the advent of the technical capability to study hadronic final states with good particle identification and at high luminosity, a new opportunity has appeared. Study of the characteristics of parton propagation and hadron formation as they unfold within atomic nuclei are now being used to understand the coherence and spatial features of these processes and to refine new experimental tools that will be used in future experiments. Fixed-target data on nuclei with lepton and hadron beams, and collider experiments involving nuclei, all make essential contact with these topics and they elucidate different aspects of these same themes. In this talk, a survey of the most relevant recent data and its potential interpretation will be followed by descriptions of feasible experiments at an electron-ion collider, in the context of existing measurements as well as the experiments performed following the upgrade of Jefferson Lab to 12 GeV.