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Probing Emergent Hadronic Mass with Deep Exclusive Meson Production

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A key question of modern physics concerns how the bulk of the universe's visible mass emerges from the Standard Model (SM). Some of this mass is generated by Higgs boson couplings to matter fields in the SM, but of the constituents of atomic matter, this suffices to explain only the mass of electrons in its entirety. The overwhelming majority of atomic mass resides in the nucleus, which is composed of neutrons and protons (nucleons), bound together by the exchange of pions and other mesons at shorter ranges. As far as these nucleons and pions are concerned, the Higgs-generated mass component is only a small fraction. The overhelming majority of the mass comes from the dynamical quark-gluon interactions of QCD, through a mechanism termed "Emergent Hadronic Mass" (EHM). Paradoxically, the study of the lightest pseudoscalar mesons, the pion and kaon, appear to hold the key to a further understanding of EHM and structure mechanisms. I will discuss the contributions the PionLT and KaonLT experiments at Jefferson Lab are expected to make towards the resolution of this puzzle, as well as the role of proposed future extensions of these measurements using the Jefferson Lab 22 GeV upgrade and the Electron-Ion Collider.

Keyword-1

hadrons/QCD

Keyword-2

electron scattering

Keyword-3

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