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Challenges and Opportunities in Nucleon and Nuclear Femtography[1]

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Deeply virtual exclusive scattering (DVES) offers the exciting possibility of imaging the spatial distributions of quarks and gluons in the nucleon and in nuclei, referred to as Nuclear Femtography. These processes are studied via the reactions $l + {}^{Z}A \to l + M + {}^{Z'}A$, where l denotes an electron or muon, ${}^{Z}A$ denotes a target nucleon or nucleus, and M is a final state meson or gamma-ray. The Center-of-Mass frame of the exchanged virtual photon and the target define a preferred longitudinal axis. In high energy scattering, the lepton kinematics define the light-cone momentum transfer to the struct parton, and the net transverse momentum transfer to the target is Fourier-conjugate to the parton's spatial coordinate. The longitudinal-momentum and transverse-spatial distribution of partons is dependent upon their spin polarization. These degrees of freedom are accessible with polarized leptons and polarized targets (beams, or fixed). I will review the experimental requirements and prospects for nuclear femtography , including the past programs at HERA and HERMES, the ongoing programs at Jefferson Lab and COMPASS, and the proposed Electron Ion Collider (EIC).

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