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Nucleon transverse spin structure in the valence quark region: Probing color forces

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The first direct observation that protons are not elementary objects and the discovery that their constituents, dubbed partons, are point-like particles made use of elastic and deep inelastic (DIS) scattering of electrons off protons, respectively. With the advent of quantum chromodynamics (QCD), the modern theory of strong interactions, partons were identified as quarks and gluons and an intensive theoretical effort is still underway to grasp the full consequences of this theory. Recently scattering experiments at Jefferson Lab using a 6 GeV polarized electron beam and polarized targets at high luminosity have allowed us to delve deeper into the role of partons dynamics in the nucleon (proton and neutron). These studies of dynamics in the valence quark region are helping us unravel the rich but elusive structure of the confined building blocks of matter and impacting our understanding of the non-perturbative aspects of QCD through comparisons with lattice QCD and models. I will present recent results of measurements of the average color electric and magnetic forces acting on the struck quark in a proton, due to the remnant di-quark as it start its journey to emerge as a hadron. A flavor separation of the color force acting on the up and down quarks is carried out by combining measurements on polarized protons and neutrons. I will conclude by describing the planned measurements with the 12 GeV upgrade of Jefferson Lab to complete our picture of nucleon transverse spin structure in the valence region.