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Parton distributions from light-front holographic QCD

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Determining quark spin dependent distributions in the proton is a key task in hadron physics to understand strong interactions. Existing world data show positive polarization for up quarks and negative polarization for down quarks. However, perturbative QCD predicts maximally positive polarization for both up and down quarks at large longitudinal momentum limit, $x \rightarrow 1$, while extrapolations from global fits as well as many nucleon structure models favor a small negative polarization for down quarks at the limit. We present a new approach, motivated by the gauge/gravity correspondence and Veneziano duality, to study polarized quark distributions. Given the knowledge of unpolarized distributions, we have parameter-free determinations of corresponding polarized distributions, which are consistent with existing experimental data in the measured region and also with the perturbative QCD predictions at the large- x limit. Particularly, we predict the position where a sign change is expected for the polarization of down quarks. Our results will be tested very soon in upcoming experiments.

Authors: LIU, Tianbo (Jefferson Lab); SUFIAN, Raza (University of Kentucky); DE TERAMOND, Guy (UCR); DOSCH, HansGunter; BRODSKY, Stanley (SLAC National Accelerator Laboratory); DEUR, Alexandre (Jefferson Lab)

Presenter: LIU, Tianbo (Jefferson Lab)

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