

Complete Leading-twist Baryon Light-cone Distribution Amplitudes from LQCD

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Baryon light-cone distribution amplitudes (LCDAs) encode the longitudinal momentum distributions of valence quarks and provide important nonperturbative inputs for hard exclusive processes involving baryons. In this talk, I will present the first lattice determination of the three leading-twist Λ -baryon LCDAs, V , A , and T , as full two-dimensional functions of the valence-quark momentum fractions.

This work establishes a systematic large-momentum effective theory (LaMET) framework for determining leading-twist baryon LCDAs from lattice QCD, covering the complete procedure from equal-time three-quark correlators to the momentum-fraction dependence of physical light-cone amplitudes. Key ingredients include a two-dimensional hybrid renormalization prescription in coordinate space, an HQET-motivated large- λ extrapolation strategy for controlling the long-distance behavior of Euclidean correlators, one-loop perturbative matching to the light-cone amplitudes in the $\overline{\text{MS}}$ scheme, and controlled extrapolations to the continuum, physical-pion-mass, and infinite-momentum limits.

As a phenomenological illustration, replacing the asymptotic LCDA with the lattice-determined distributions leads to an $\mathcal{O}(10\%)$ shift in the Λ electromagnetic form factor at perturbative scales. These results provide the first complete multidimensional, x -dependent baryon LCDAs from first principles and establish a framework for future lattice studies of baryon light-cone structure.

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