Hybrid Renormalization Scheme for the Lattice Calculation of Baryon LCDAs

Lattice QCD computations within the framework of large momentum effective theory (LaMET) provide a first-principles approach to studying hadron structure. However, LaMET matching requires a suitable perturbative scheme, which necessitates the development of appropriate renormalization methods connecting the lattice scheme to the perturbative scheme. Various renormalization schemes—such as RI-MOM and the ratio scheme—have been widely used in lattice calculations. In this talk, we present in detail the "hybrid renormalization" scheme implemented in our lattice calculation of the leading-twist lightcone distribution amplitudes (LCDAs) for light baryons. To address the greater complexity of baryonic systems compared to mesonic ones, we employ multiple types of region division to handle possible short-distance divergence structures. This hybrid approach combines self renormalization (which extracts the lattice-discretization-induced divergences from the zero-momentum matrix elements at different lattice spacings) at large separations with the ratio scheme at short distances, effectively avoiding singularities that are detrimental to numerical LaMET matching. Our results demonstrate that this scheme optimally subtracts lattice-discretization-induced divergences across the entire range of the nonlocal baryon matrix elements, while yielding smooth, continuum-like behavior suitable for further analysis.

Primary author(s) : Mr BAI, Haoyang

Co-author(s) : ZHANG, Mu-Hua (Shanghai Jiao Tong University); HUA, Jun (South China Normal University); JI, Xiangdong; Prof. WANG, Wei

Presenter(s) : Mr BAI, Haoyang