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Gluon Parton Distribution of the Nucleon from Lattice QCD in the $2+1+1$ Physical-Continuum Limit

Thursday, 30 March 2023 14:40 (20 minutes)

We present the first physical-continuum limit x-dependent nucleon gluon distribution from lattice QCD using the pseudo-PDF approach, on lattice ensembles with $2+1+1$ flavors of highly improved staggered quarks (HISQ), generated by MILC Collaboration. We use clover fermions for the valence action on three lattice spacings $a \approx 0.9$, 0.12 and 0.15~fm and three pion masses $M_\pi \approx 220$, 310 and 690~MeV, with nucleon two-point measurements numbering up to $O(10^6)$ and nucleon boost momenta up to 3~GeV. We study the lattice-spacing and pion-mass dependence of the reduced pseudo-ITD matrix elements obtained from the lattice calculation, then extrapolate them to the continuum-physical limit before extracting $xg(x)/\langle x\rangle_g$.We use the gluon momentum fraction $\langle x\rangle_g$ calculated from the same ensembles to determine the nucleon gluon unpolarized PDF $xg(x)$ for the first time entirely through lattice-QCD simulation. We compare our results with previous single-ensemble lattice calculations, as well as selected global fits.

Submitted on behalf of a Collaboration?

No

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