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Nucleon Tomography and Generalized Parton Distribution at Physical Pion Mass from Lattice QCD

We present the first lattice calculation of the nucleon unpolarized generalized parton distribution (GPD) at the physical pion mass using a lattice ensemble with 2+1+1 flavors of highly improved staggered quarks (HISQ) generated by MILC Collaboration, with lattice spacing $a \approx 0.09$ -fm and volume $64^3 \times 96$. We use momentum-smearred sources to improve the signal at nucleon boost momentum $P_z \approx 2.2$ -GeV, and report results at 6 nonzero momentum transfers $[0.2, 0.9]$ GeV².

Nonperturbative renormalization in RI/MOM scheme is used to obtain the quasi-distribution before matching to the lightcone GPDs. The three-dimensional distributions $H(x, Q^2)$ and $E(x, Q^2)$ at $\xi = 0$ are presented, along with the three-dimensional nucleon tomography and impact-parameter-dependent distribution for selected Bjorken x at $\mu = 3$ -GeV in $\overline{\text{MS}}$ scheme.

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