



Contribution ID: 19

Type: **not specified**

Direct calculation of parton distributions in momentum space from lattice QCD

Tuesday, 7 July 2026 13:30 (30 minutes)

Coulomb-gauge quasi-parton distributions can be computed directly in momentum space on a finite lattice, enabled by the commutativity of their renormalization and Fourier transform. This approach removes the formal inverse problem in coordinate-space methods. Our momentum-space pion quasi-distributions agree with coordinate-space results Fourier transformed with asymptotic extrapolation, indicating that the formal inverse problem in the latter is not a practical concern here. We further extend the framework to higher dimensions and obtain the first 3D image of the pion directly from lattice QCD.

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Session Classification: Session I