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Interpolating the 't Hooft Model Between Instant and Front Forms in the Coulomb Gauge

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Motivation

- Infrared Divergences relation to quark confinement (discussed in [1] using axial gauge)
- LFD has 7/10 kinematic Poincaré operators, saving dynamical efforts and maximizing the number of kinematic generators
- Alternative quasi-PDF implementable in lattice
- Resolution to the Π^0 Problem

Resolving the Π^0 problem

$$A^0 = 0$$
Coulomb Gauge

$$A^{\hat{+}} = 0$$
Interpolating Coulomb Gauge

$$A^+ = A_- = 0$$
Light-Front Gauge

$$A_{\hat{-}} = 0$$
Interpolating Axial Gauge

$$A^1 = 0$$
Axial Gauge

- Connect the Coulomb gauge and axial gauge through interpolation and a Gauss operator seen in [3].

Expected Predictions

Starting from the Lagrangian, we solve for the mass gap equation via the Hamiltonian and Feynman diagram analysis.

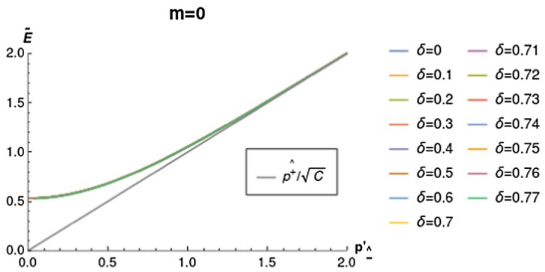

Fig 1. Mass gap solution for m=0 case [1]

We can apply the mass gap solutions to solve the bound state equations for the spectroscopy and wavefunctions

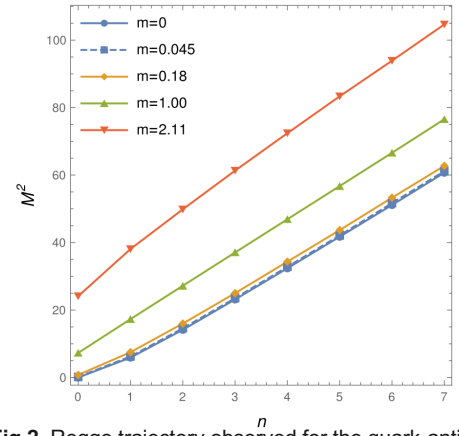

Fig 2. Regge trajectory observed for the quark-antiquark bound state in the axial gauge, we expect the same result in the Coulomb gauge. [1]

Quasi Parton Distribution Functions

- Converge to PDFs in LFD
- Dependent on Pz and δ

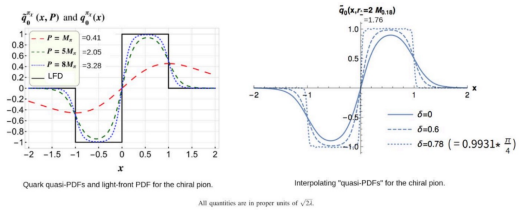

Fig 3. light-front PDF (left) shown in [2] compared with interpolating quasi-PDF in [1]

Future Work and Bibliography

- Interpolating between Coulomb Gauge and Light Front Gauge
- Interpolating dynamics in 3+1 with Nc = 3 in time-like region to study the color confinement.
- Discussing the QCD(1+1) axial anomaly using the Gauss operator technique
- Testing alternative quasi-PDFs on the lattice
  - Does not suffer from the large momentum boost
  - Exhibit frame dependence and delta dependence

Please scan the QR code to view the bibliography.