**q / q̄ Correlations in Heavy-Light Ion Collisions**

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**Formalism**
- Compute spatial correlations among q and q̄
  - CGC formalism in “heavy / light” regime
    - Quark pair production is described by wave functions in light-front perturbation theory.
    - Instantaneous scattering at t = 0
- High-energy scattering of partons occurs via Wilson line color rotations
  - Quasi-classical (Gaussian) limit
- Dynamics via color multipole operators:
  - Dipole
  - Quadrupole
- Light-Front Wave Functions for Pair Production

**Single-Pair Production**
- At LO: quark pair production from one soft gluon
  - (q q̄) only
  - Correl. fn. normalized by gluon production
- Color dipoles (GBW model [1], large-Nc approx)
  - Massive quark splitting wave functions
- Quarks carry fractional baryon number charge
  - LO contribution to baryon number correlations

**Double-Pair Production**
- At NLO: two pairs are produced
  - (q q̄) and (q̄ q)
  - (q q̄) at r_T = 1/m
  - Fermi statistics leads to negative contributions from quark entanglement (Pauli blocking)

**Conclusions**
- We calculated the (q q̄) spatial correlation functions for single-pair production
- We outlined the mechanisms and length scales associated with double-pair production
- This is one step toward a numerical package for initializing conserved charges in heavy ion collisions.

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**References**