Recap of McLerran-Venugopalan (MV) model

- study of small-x gluon field in large nucleus.

* longitudinal coherent length of such gluons can be much longer than the size of nucleus.

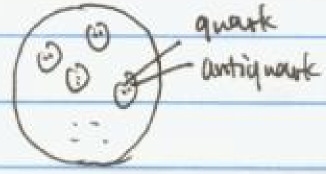
- momentum scale associated with small-x gluons

$$\mu^2 \sim \Lambda_{QCD}^2 A^{1/3} \gg \Lambda_{QCD}^2$$

↳ Classical field!

- large-x partons serve as classical source.

How we calculated it:



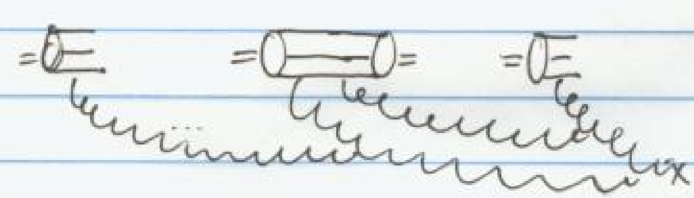
1) source $\rho_{cov}(\vec{x}) = \sum_{a=1}^{N_c^2-1} t^a \rho^a_{cov}(\vec{x})$

2) Classical Yang-Mills equation $D_\mu F^{\mu\nu} = J^\nu$

solve for gluon field A_{cov}

3). Gauge transformation $A^{LC} = S A^{cov} S^{-1} - \frac{i}{g} (\partial_\mu S) S^{-1}$

Result:



Alternative :

$$\rho_{LC} = S \rho_{cov} S^{-1}$$

$\hookrightarrow$ continuous density approach

When calculating physical observables, one has to integrate over all charge densities with some weight function $W[\rho_{LC}]$. Valence quarks are independent, W has to be Gaussian.

$$W = \exp\left\{ -\int dx_\perp^2 \int_{-\infty}^{+\infty} dx^- \frac{tr[\rho_{LC}^2(x^-, x_\perp)]}{\mu^2(x^-, x_\perp^2)} \right\}.$$

$$\langle \hat{O}_p \rangle = \frac{\int D\rho_{LC} \hat{O}_p W[\rho_{LC}]}{\int D\rho_{LC} W[\rho_{LC}]}$$

Jalilian-Marian-Iancu-Mclerran-Weigert-Leonidov-Kovner evolution equation.

- quantum corrections to the classical MV model.
- Include the small-x evolution in the wave function of the target.
- $W[\rho_{LC}] \to W_Y[\rho_{LC}]$
- Small-x evolution. $Y \to Y + dY$.
  the gluons at Y become large-x gluons, and are incorporated into a source of classical fields.
- Color Glass Condensate (CGC)