

Transport of jets and heavy quarks in the glasma pre-equilibrium stage

$$\int \mathcal{D}A_{\text{vramescu}}$$

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Showcasing results done in collaboration with

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Outline

Introduction

Stages • Initial stage • Hard probes

Glasma fields

CGC • Features • Frameworks

Transport in glasma

Classical transport • Field correlators

Results

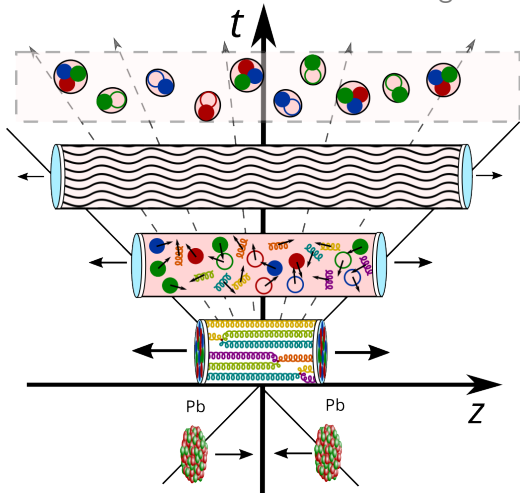
Transport coefficients • Observables

Open questions



Heavy-ion collisions

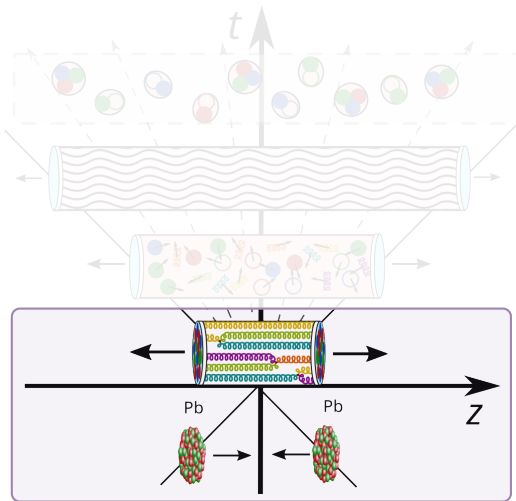
Stages at weak coupling



Collision stages

- ▶ Before collision $\tau \leq 0 \text{ fm}/c$
Gluon field of high-energy nucleus
- ▶ **Initial stage** $\tau \lesssim 0.3 \text{ fm}/c$
Glasma strong classical gluon fields
- ▶ Thermalization $\tau \lesssim 1 \text{ fm}/c$
Effective kinetic theory
- ▶ Equilibration $\tau \lesssim 10 \text{ fm}/c$
Relativistic hydrodynamics
- ▶ Final stages $\tau \geq 10 \text{ fm}/c$
Particlization, hadronization

Initial stage of collision



Glasma initial stage

- ▶ Color glass condensate
QCD in the high-energy limit
- ▶ Weakly coupled $\alpha_s \ll 1$
- ▶ **Classical gluon fields**
Occupation number $\sim 1/\alpha_s \gg 1$
- ▶ Non-perturbative
- ▶ **Lattice gauge theory**
Numerical solution
- ▶ **Out-of-equilibrium**

Jets as probes



Heavy quarks as probes



CGC and glasma



Features of glasma fields



Frameworks for glasma



Wong's equations



Correlator method



Transport coefficients



Phenomenology



Open questions

