Contribution ID: **286** Type: **Parallel Talk**

Kinetic transport is needed to reliably extract shear viscosity from pA and AA data

Tuesday, 15 May 2018 11:50 (20 minutes)

The azimuthal anisotropies of particle spectra measured in proton-nucleus (pA) and nucleus-nucleus (AA) collisions play a key role in constraining QCD matter properties like the shear viscosity over entropy density ratio eta/s. We compare calculations of v_n's from viscous fluid dynamics and from kinetic transport which start both from the same initial conditions and which implement the same matter properties. We observe that both approaches lead to parametrically different eta/s-dependencies of the elliptic anisotropy v_2, and they may thus lead to quantitatively different results for the phenomenologically inferred value of eta/s. The parametric differences can be traced to the boost-invariant longitudinal expansion of pA and AA collisions which induces in fluid dynamic results of the eta/s-dependence of v2 a dominant sensitivity on the initial conditions. Transport theory is free of this problem and it accounts for the order of magnitude of experimentally observed signal strengths v_n with sizeable mean free path.

Content type

Theory

Collaboration

Centralised submission by Collaboration

Presenter name already specified

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Session Classification: Collective dynamics

Track Classification: Collective dynamics