
JET-MEDIUM EXCITATIONS INDUCED Λ POLARIZATION AS A GRADIENT TOMOGRAPHIC PROBE IN HEAVY-ION COLLISIONS

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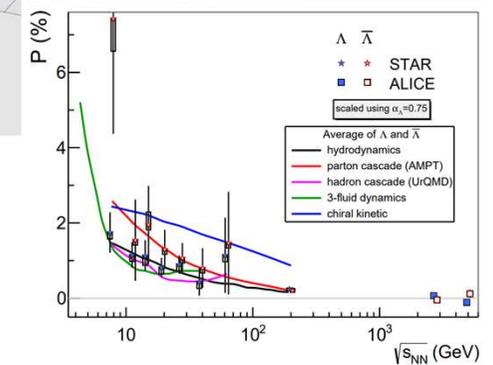
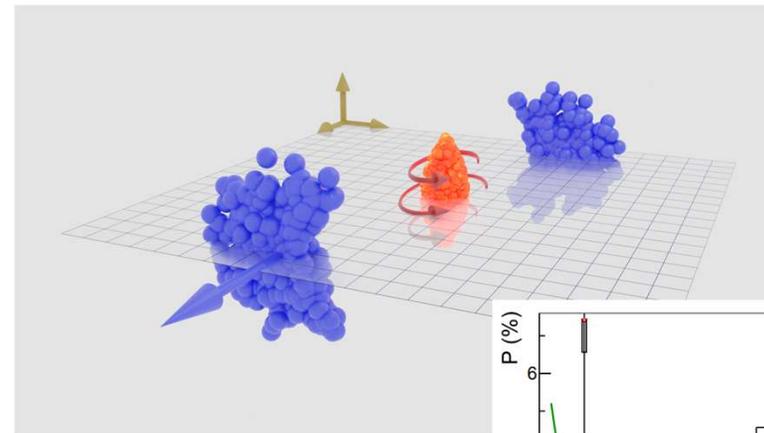
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GLOBAL LAMBDA POLARIZATION ON THE QGP

- Non-central collisions generates QGP carrying angular momentum
- On the hydrodynamics description, this implies non-zero vorticity during hydro evolution
- Vorticity couples to hadrons' spins, polarizing them
- Measured experimentally by STAR
 - Hydrodynamics describes successfully global polarization



[Annu. Rev. Nucl. Part. Sci. 70:1, 395-423 \(2020\). \[arXiv 2003.03640\]](#)

JETS AND POLARIZATION

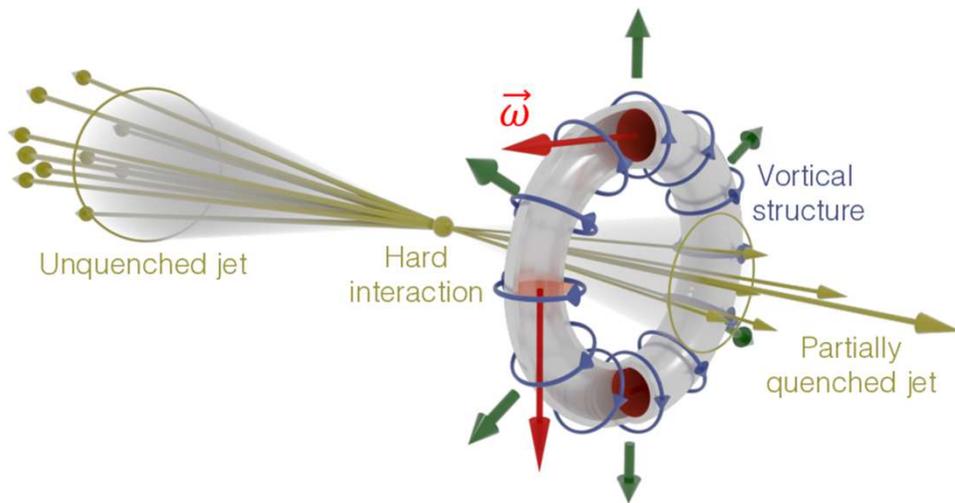


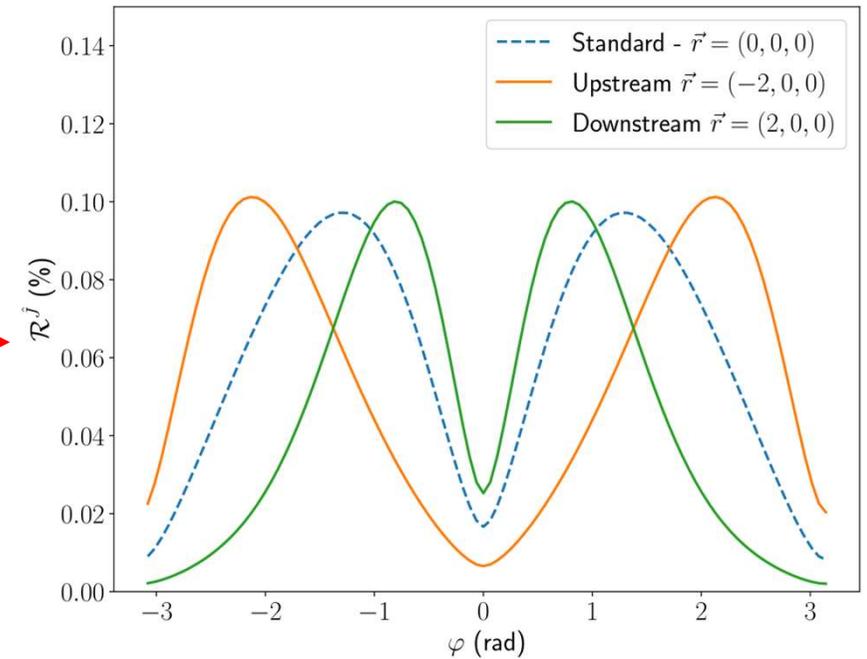
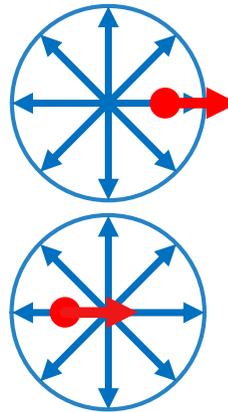
Figure from [[Phys.Lett.B820, 136500 \(2021\)](#)]

- Jet quenching was one of the greatest evidences for the QGP.
- It was long hypothesized that medium-jet interactions could lead to vorticity in the medium
- We argued in [[Phys.Lett.B820, 136500 \(2021\)](#)] that these interaction would be in the form of a vortex ring, which could be measured by means of ring observable

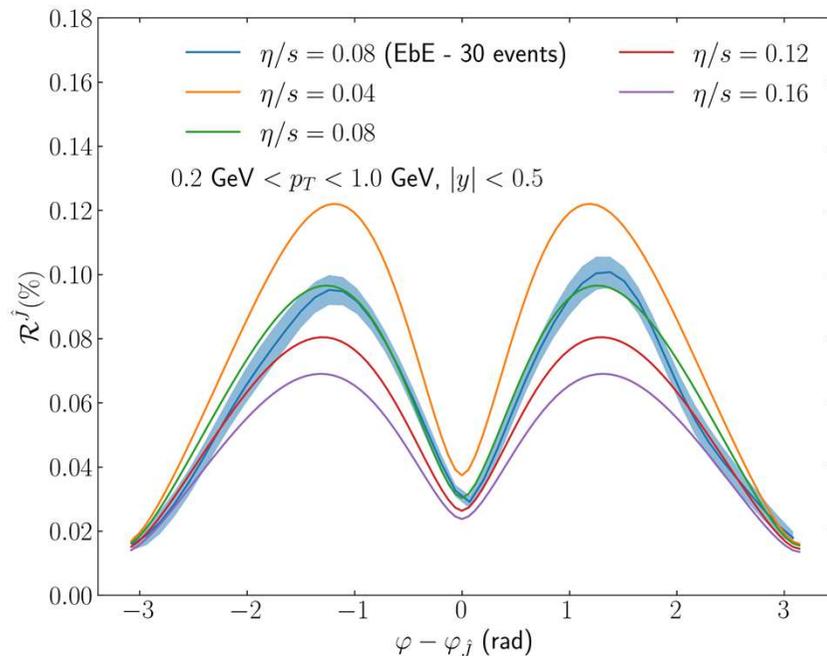
$$R^J = \frac{\vec{P} \cdot (\hat{J} \times \vec{p}_\Lambda)}{|\hat{J} \times \vec{p}_\Lambda|}$$

JET-INTERACTION POSITION SCAN

- We model jet-medium interaction as a source term in (3+1)D viscous hydrodynamics in Pb-Pb at 2.76 TeV collisions
- We perform a position scan on top of a smooth IC
- Jet direction is always on $+\hat{x}$ direction
 - Downstream: Jet-interaction position aligns fluid expansion with jet-momentum
 - Particization hypersurface hits the vortex ring from forward direction, resulting in peaks positioned in a narrower angle.
 - Upstream: Jet-interaction position anti-aligns fluid expansion with jet-momentum
 - Particization hypersurface hits the vortex ring from backward direction, resulting in peaks positioned in a wider angle.



EBE SIMULATIONS AND VISCOSITY DEPENDENCE



- One of the motivations for ring observable is to eliminate vorticity from non-jet sources
 - E.g. global polarization, mini-rings due to fluctuating ICs, flow-induced jets etc
- We perform EbE simulations and compare with the smooth case
 - General agreement between the two cases.
- Viscosity presents similar behavior to what observed originally at [[Phys.Lett.B820, 136500 \(2021\)](#)]
 - Higher viscosity dissipates vortex faster, resulting in a weaker signal in particlization hypersurface

CONCLUSIONS

- Ring observable can be used as a signature of fluid's opacity
- Robust against EbE fluctuations
- Signal strength may be used as a probe of viscosity
 - Not the only source: model of jet-medium interaction surely will affect this as well
- It may be used as a tool for probing position of medium-jet interaction
- Signal is of order of sub-percent: may be challenging to measure it experimentally