JET-MEDIUM EXCITATIONS INDUCED $\Lambda$ POLARIZATION AS A GRADIENT TOMOGRAPHIC PROBE IN HEAVY-ION COLLISIONS

WILLIAN M. SERENONE, DAVID D. CHINELLATO, MICHAEL LISA, VITOR HUGO RIBEIRO, CHUN SHEN, JUN TAKAHASHI, GIORGIO TORRIERI

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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

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:

\[ R^l = \frac{\vec{p} \cdot (\vec{j} \times \vec{p}_\Lambda)}{|\vec{j} \times \vec{p}_\Lambda|} \]
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.
    - Particlization 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.
    - Particlization hypersurface hits the vortex ring from backward direction, resulting in peaks positioned in a wider angle.

![Graph showing the effect of jet-interaction position on fluid expansion and particleization hypersurface.](image)
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 particilization 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