

THE PUZZLE OF HYDRODYNAMICS IN HEAVY-ION COLLISIONS

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ABSTRACT

The use of relativistic hydrodynamics in Heavy-Ion Collisions is puzzling. The classical requirements of small gradients and pressure corrections are often significantly violated. The classical expectations are subverted [1], a free quantum gas has the entropy flow of a perfect fluid, despite having pressure correction, and entropy is produced, despite being a non-interacting gas. In general the quantum corrections are large with respect to the kinetic limit [2]. It is questionable then any direct derivation of hydrodynamics from the relativistic Boltzmann equation. The method of moments, on the other hand can be generalized to the full off-shell (quantum) regime [3].

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REFERENCES

- [1] D. Rindori, L. Tinti, F. Becattini, D.H. Rischke, *relativistic quantum fluid with boost invariance*, Phys.Rev.D **105** (2022) 5, 056003.
- [2] L.Tinti, *Quantum free streaming: Out of equilibrium expansion of the free scalar field*, Phys Rev D **108** (2023) 7, 076022.
- [3] L. Tinti, *Off-shell Hydrodynamic expansion*, Phys Rev D **108** (2023) 3, 036015.