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Towards Causal Relativistic Spin Hydrodynamics

Relativistic hydrodynamics has been plagued with the problem of causality for a long time. While the proposal of MIS theories resulted in the restoration of causality, it introduced new degrees of freedom with no thermodynamic origin. Recent formulations of first-order hydrodynamics theories of BDNK type, where the hydrodynamic fields have generalized definitions, are both causal, and use only thermodynamically meaningful variables. Looking at the increasing interest in the formulation of relativistic spin hydrodynamics, mostly due to the recent discovery of the spin polarization phenomenon in heavy-ion collisions, we attempt to build a theory of relativistic spin hydrodynamics with such general definitions of the hydrodynamic fields from kinetic theories - first using the extended relaxation time approximation and then using the novel relaxation time approximation.

Partly based on: [arxiv:2408.14462](https://arxiv.org/abs/2408.14462).

Category

Theory

Collaboration (if applicable)

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