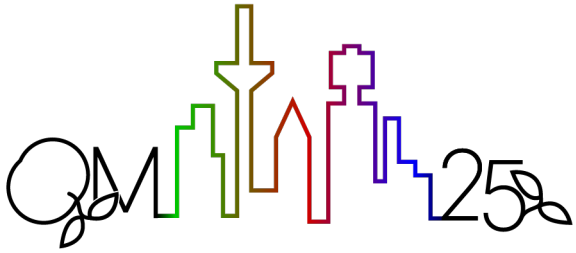

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Dynamical constraints for pseudo-gauge transformation

The concept of pseudo-gauge freedom, which is essential for defining conserved currents in effective field theories like relativistic hydrodynamics, continues to inspire significant debate and re-interpretation. In this talk, I will present recent insights that clarify the role and limitations of pseudo-gauge transformations and pseudo-gauge invariance in hydrodynamic systems.

For pseudo-gauge transformations connecting two symmetric energy-momentum tensors, we identify a necessary condition for the associated super-potential: it must satisfy a specific conservation law, referred to here as the "STS condition." Notably, this constraint is challenging to fulfill in hydrodynamic frameworks based on standard variables like temperature, baryon chemical potential, and flow velocity. However, in a particular case—the boost-invariant flow—the STS condition is automatically satisfied. This allows for a non-trivial residual pseudo-gauge transformation characterized by a single scalar field. In this scenario, the bulk and shear viscosity coefficients exhibit pseudo-gauge dependence, yet a specific linear combination within the hydrodynamic equations remains pseudo-gauge invariant.

This finding sheds new light on the role of pseudo-gauge transformations, offering valuable implications for theoretical approaches and practical applications in high-energy physics.

Based on:
"Dynamical constraints on pseudo-gauge transformations", arXiv:2411.06249 [hep-ph] by Z. Drogosz, W. Florkowski, M. Hontarenko and R. Ryblewski.

Category

Theory

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