Contribution ID: **40** Type: **Oral report**

Relativistic second-order spin hydrodynamics from Zubarev's non-equilibrium statistical operator

Friday, 16 August 2024 09:55 (15 minutes)

We present a new derivation of relativistic second-order spin hydrodynamics for quantum systems using Zubarev's non-equilibrium statistical-operator formalism. This is achieved by a systematic expansion of the energy-momentum tensor, the spin tensor and the charge current to second order in deviations from equilibrium. As a concrete example, we obtain the relaxation equations for the shear-stress tensor, the bulk-viscous pressure, the charge-diffusion currents and the dissipative currents appearing in the spin tensor required to close the set of equations of motion for relativistic second-order spin hydrodynamics. We also identify new transport coefficients which describe the relaxation of dissipative processes to second-order and express them in terms of equilibrium correlation functions, thus establishing new Kubo-type formulas for second-order transport coefficients.

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Session Classification: 分会场三

Track Classification: 重离子物理