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Ideal hydrodynamics with spin

Based on the Wigner function at local thermal equilibrium, we derive hydrodynamical quantities for a system of polarized spin-1/2 particles, including the particle number current density, the energy-momentum tensor, the spin tensor, and the dipole moment tensor. Comparing with ideal hydrodynamics without spin, we find additional corrections at first and second orders in gradient. The Wigner function is expressed in terms of matrix-valued distributions, whose equilibrium formulas are characterized by thermodynamical parameters as shown in quantum statistics. By solving hydrodynamical equations, we derive equations of motions for these parameters at the leading two orders in gradient.

Topics

Hydrodynamics and Collective Flows

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