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Damping and polarization rates in near equilibrium spin transport

The collision terms in spin transport theory are analyzed in Kadanoff-Baym formalism for systems close to equilibrium. The non-equilibrium fluctuations in spin distribution include both damping and polarization, with the latter arising from the exchange between orbital and spin angular momenta. The damping and polarization rates or the relaxation times are expressed in terms of various Dirac components of the self-energy. Unlike the usually used Anderson-Witting relaxation time approximation assuming a single time scale for different degrees of freedom, the polarization effect is induced by the thermal vorticity and its time scale of thermalization is different from the damping. The numerical calculation in the Nambu–Jona-Lasinio model shows that, charge is thermalized earlier and spin is thermalized later.

Topics

Spin Alignment

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