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Quantum kinetic theory for dynamical spin polarization from QED-type interaction

We investigated the dynamical spin polarization of a massless electron probing an electron plasma in locally thermal equilibrium via the Moller scattering from the quantum kinetic theory. We derive an axial kinetic equation delineating the dynamical spin evolution in the presence of the collision term with quantum corrections up to \mathcal{O}(\hbar)O(ℏ) and the leading-logarithmic order in coupling by using the hard-thermal-loop (HTL) approximation, from which we extract the spin-polarization rate induced by the spacetime gradients of the medium. When the electron probe approaches local equilibrium, we further simplify the collision term into a relaxation-time expression. Our kinetic equation may be implemented in the future numerical simulations for dynamical spin polarization.

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