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Quantum Kinetic Theory of Spin Polarization of Massive Quarks in Perturbative QCD

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We present the quantum kinetic equation for spin polarization of massive quarks in leading log order of perturbative QCD, which describes time evolution of the spin density matrix in momentum space of a massive quark interacting with a background QCD plasma. We find that the time evolution operator of the spin density matrix, or the quantum kinetic collision terms, are universally of order $\alpha_s^2 \log(1/\alpha_s)$ in terms of the QCD coupling constant $\alpha_s = g^2/(4)$. Our quantum kinetic equation is valid for an arbitrary quark mass $m \gg m_D\ gT$, where m_D is the Debye mass, and can be used to study relaxation dynamics of spin polarization of massive quarks in perturbative QCD regime.

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