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Spin Quantum Kinetics in Relaxation and Transport of Semiconductors HAN-CHIEH LEE, CHUNG-YU MOU, Department of Physics, National Tsing Hua University, STEPHEN A. LYON, Department of Electrical Engineering, Princeton University — Generalized Kadanoff-Baym Equation (GKBE) with spin degree of freedom is firstly presented and its theoretical framework of applications, which aims to semiconductor quantum kinetics in femtosecond and nanometer scales, demonstrated. The GKBE was constructed by Green functions thermally averaging Pauli equation of motion with using Langreth theorem. As applied for relaxation, Kadanoff-Baym ansatz was made and carrier-carrier scattering (CCS) with random-phase approximation considered. The derivation can simulate an evolution of excited carriers spreading via CCS, buildup of magnetic field by Rashba effect and formation of spin relaxation, where energy non-conserving event and memory effect are figured out. For transport, retarded Green functions were retrieved from spin Dyson equation as an input for GKBE with the presence of electron-phonon (impurity) interaction. The part is useful for spin Hall effect in precisely estimating spin current and accumulation in nanostructures or ballistic regime.

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