Dynamics of Pure Spin Current in High-frequency Quantum Regime

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Abstract

Pure spin current is a powerful tool for manipulating spintronic devices, and its dynamical behavior is an important issue. By using mesoscopic transport theory for electron tunneling induced by spin accumulation, we investigate the dynamics of the spin current in the high-frequency quantum regime, where the frequency is much larger than temperature and bias voltage. Besides the thermal noise, frequency-dependent finite noise emerges, signaling the spin current across the tunneling barrier. We also find that the autocorrelation of the spin current exhibits sinusoidal oscillation in time as a consequence of the Pauli exclusion principle even without any net charge current.

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