

Spatial Distribution of Electronic Spins in a Quasi-One-Dimensional Tight-Binding Model with Spin-Dependent Hopping

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We have theoretically studied intrinsic spin Hall effect (SHE) in a quantum wire (QW). Our numerical calculations show that the distribution of electronic spins has characteristic spatial dependence reflecting SHE in a quasi-one-dimensional tight-binding model with spin-dependent hopping. We consider the two-terminal configuration giving the charge current where electronic reservoirs are connected to the both ends of the finite-length QW by ideal leads. The spatial distribution of spins is calculated by Büttiker's method¹ using local potential probes under the appropriate boundary conditions for charge and spin currents. The difference between the numbers of up and down spins, or spin polarization, shows spatial oscillation in a direction perpendicular to the charge current and reaches the maximum around one edge and the minimum around the other edge, which suggests spin accumulation localized around edges in a QW due to SHE.

¹M. Büttiker, Phys. Rev. B **33**, 3020 (1986); *ibid.***32**, 1846 (1985).