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Spin current and polarization in impure 2D electron systems with spin-orbit coupling

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We have considered effects of impurity potential scattering on the spin Hall conductivity of a 2D electron system, assuming that the scattering rate τ^{-1} and the spin-orbit gap Δ are small compared to the Fermi energy, but for arbitrary value of $\Delta\tau$. For a 2D electron system with pure Rashba spin-orbit coupling, or pure linear Dresselhaus coupling, we find a vanishing dc spin Hall conductivity in the bulk, for arbitrary form of the impurity potential, while non-zero spin Hall currents may occur near contacts [1]. For more general forms of the spin-orbit interaction, or for a 2D hole system in III-V materials, the bulk spin Hall conductivity should vanish in the limit of small angle impurity scattering, but may be non-zero if large-angle scattering is important. Implications of impurity scattering for spin accumulation will also be discussed. This work has been done in collaboration with E. G. Mishchenko and A. V. Shytov. [1] E. G. Mishchenko, A. V. Shytov, and B. I. Halperin, Phys. Rev. Lett. **93**, 226602 (2004); and unpublished work.