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Monte Carlo Simulation of Spin-Injection Hall Effect LIVIU P. ZÂRBO, JAIRO SINOVA, Department of Physics, Texas A&M University, USA, JÖRG WUNDERLICH, Hitachi Cambridge Laboratory, United Kingdom, TOMAŠ JUNGWIRTH, Institute of Physics, ASCR, Czech Republic, SHOU-CHENG ZHANG, Department of Physics, Stanford University, USA — The spin-injection Hall effect,which is the newest addition to the spintronic Hall effect family, consists in the transversal deflection of a charge spin-polarized current injected in a spin-orbit coupled semiconductor channel which results in transverse Hall voltage whose magnitude varies along the channel direction. Just as in the case of spin Hall effect, the phenomenon is due to both intrinsic and extrinsic (impurity driven) spin-orbit scattering. We develop a semiclassical spin-dependent Monte Carlo simulation technique which enables us to quantitatively explain the mechanisms of spin-injection Hall effect in experimentally relevant systems. This is achieved by incorporating both intrinsic and extrinsic contributions to anomalous Hall effect (AHE) which are rigorously derived within the recently developed gauge invariant semiclassical theory of AHE. The advantage of this approach over a fully quantum mechanical treatment is that it enables us to investigate the spin-injection Hall effect in micrometer-size devices while still retaining the essential physics.

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