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Multi-directional Spin Transport at Interfaces with Spin-Orbit Coupling VIVEK AMIN, Center for Nanoscale Science and Technology, NIST / Maryland NanoCenter, Univ. of Maryland, MARK STILES, Center for Nanoscale Science and Technology, NIST — Spin transport remains poorly understood in multilayer systems with interfacial spin-orbit coupling. Currently, drift-diffusion models cannot accurately treat this phenomenon, since the important consequences of interfacial spin-orbit scattering remain uncharacterized in a systematic way. Here we present boundary conditions suitable for drift-diffusion models that capture the phenomenology of interfacial spin-orbit coupling. To access their viability we compare solutions of the drift-diffusion and Boltzmann equations in a Co/Pt bilayer, since the latter approach yields a momentum-dependent distribution function equipped to describe spin-orbit scattering. A key result is that in-plane electric fields create spin accumulations and spin currents polarized in all directions, which describes a generalization of the Rashba-Edelstein and spin Hall effects. In heavy metal/ferromagnet bilayers, this phenomenon provides a mechanism for the creation of damping-like and field-like torques; it also leads to possible reinterpretations of experiments in which interfacial torques are thought to be suppressed. We discuss the interpretation of experiments involving spin orbit torque, spin pumping/memory loss, the Rashba-Edelstein effect, and the spin Hall magnetoresistance.

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