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Spin-orbit torques in magnetic bilayers

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Spintronics aims to utilize the coupling between charge transport and magnetic dynamics to develop improved and novel memory and logic devices. Future progress in spintronics may be enabled by exploiting the spin-orbit coupling present at the interface between thin film ferromagnets and heavy metals. In these systems, applying an in-plane electrical current can induce magnetic dynamics in *single domain* ferromagnets, or can induce rapid motion of domain wall magnetic textures. There are multiple effects responsible for these dynamics. They include spin-orbit torques and a chiral exchange interaction (the Dzyaloshinskii-Moriya interaction) in the ferromagnet. Both effects arise from the combination of ferromagnetism and spin-orbit coupling present at the interface. There is additionally a torque from the spin current flux impinging on the ferromagnet, arising from the spin hall effect in the heavy metal. Using a combination of approaches, from drift-diffusion to Boltzmann transport to first principles methods, we explore the relative contributions to the dynamics from these different effects. We additionally propose that the transverse spin current is locally enhanced over its bulk value in the vicinity of an interface which is oriented normal to the charge current direction.