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The precessing persistent spin helix in a magnetic field RUNDONG LI, Stanford University, JING WANG, Tsinghua University, SHOUCHENG ZHANG, Stanford University — While the spin-orbit interaction is useful for manipulating the electron spin, it could also cause spin decoherence. A Persistent Spin Helix (PSH) with infinite life time has been predicted [B. A. Bernevig et al., Phys. Rev. Lett. 97, 236601 (2006).] for 2D quantum wells with equal strength of Rashba and Dresselhaus spin-orbit coupling. This effect results from the spin SU(2) symmetry of electrons, which makes the spin density at a finite wave vector conserved. The PSH was later observed in the transient spin grating (TSG) experiment [C. P. Weber et al., Phys. Rev. Lett. 98, 076604 (2007).], where the spin density wave is pumped and its decay in the time domain is probed optically. In this work we propose measuring the PSH with an in-plane magnetic field and spin injection with alternating polarization. We derive and solve the drift-diffusion equation for the spin density and find that when the frequency of the spin injection is the same as the Larmor frequency, a great enhancement of the diffusion length and the amplitude of the spin oscillation should be observed, giving rise to a precessing PSH.

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