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Spin Circuit Model for Spin Orbit Torques in 2D Channels¹

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Recently, the unique coupling between charge and spin in topological insulators has been explored through various types of electrical measurements, which could have interesting applications. In this talk, we present a spin circuit model [1] for spin orbit torques in topological insulator surface states and other 2D channels. We show with a simple example that results from the circuit model agree well with those obtained from nonequilibrium Green's function (NEGF) based quantum transport simulation. Some predictions [2] of our model have already received experimental support and we hope this model can provide a unifying framework that can be used to critically evaluate experimental results, to explore new types of devices as well as to answer fundamental questions regarding these materials. The model for spin-orbit torques described here can be incorporated into a broader spin-circuit approach [3] which, we believe, provides a natural platform for multi-physics, multi-component spintronic devices.

[1] S. Hong, S. Sayed, and S. Datta, "Spin circuit model for spin orbit torques in 2D channels." (in preparation).

[2] S. Hong, V. Diep, S. Datta, and Y. P. Chen, "Modeling potentiometric measurements in topological insulators including parallel channels," *Phys. Rev. B.*, 86, 085131 (2012).

[3] <https://nanohub.org/groups/spintronics>

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