Electrically tunable spin-transport in low-symmetry WTe2

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We recently demonstrated that low-symmetry WTe_2 can host a novel phenomenon known as the canted Quantum spin hall effect [1] where the spin polarization of topological currents is tilted by an angle prescribed by the spin-orbit coupling. In this work, we used a combination of *ab-initio* simulations, symmetry-based modeling, and large-scale calculations of the spin Hall conductivity, to show that small electric fields can efficiently vary the spin textures of edge currents in monolayer 1T'- WTe_2 enabling electrical up to a 90-degree spin rotation of the polarization, without jeopardizing their topological character. These findings suggest a new kind of gate-controllable spin-based device, topologically protected against disorder and of relevance for the development of topological spintronics [2].

References

[1] Jose H. Garcia, Marc Vila, Chuang-Han Hsu, Xavier Waintal, Vitor M. Pereira, and Stephan Roche, Phys. Rev. Lett. **125**, 256603 (2020)
[2] Hidekazu Kurebayashi, Jose H. Garcia, Safe Khan, Jairo Sinova & Stephan Roche Nature Reviews Physics volume **4**, 150–166 (2022)

Figures

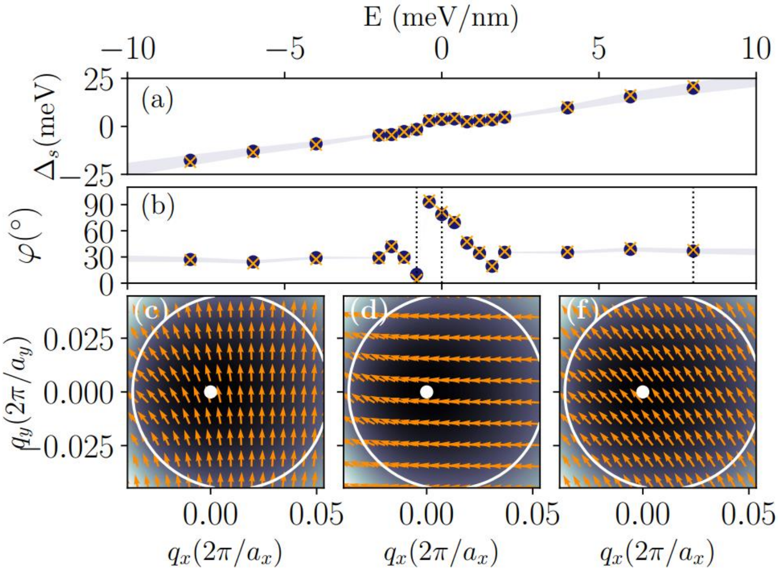

Figure 1: (a) Comparison of the conduction band spin-splitting obtained {\it ab-initio} calculations (blue dots) and the prediction of our fitted model (orange crosses). (b) The canting angle of the spin texture computed via DFT compared to the canting angle computed from the spin-orbit coupling parameters of our model (orange crosses). To determine the canting angle and spin-splitting from DFT we average over a region of the Brillouin zone around the Q points. The shaded region in (a) and (b) represents the standard deviation of the splitting and canting angle around the Q points, and is a measurement of the fluctuations away from Q. (c-e) Examples of the regions we used to compute the spin-texture for different electric felds $E=$-0.8, 0.0 and 8 mV/nm.