Highlights

Activity C - Innovative materials with strong interplay of spin, orbital, charge and topological degrees of freedom - 2021

Room-temperature ferroelectric switching of spin-to-charge conversion in germanium telluride

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The development of spintronic devices has been limited by the poor compatibility between semiconductors and ferromagnetic sources of spin. The broken inversion symmetry of some semiconductors may allow for spin–charge interconversion, but its control by electric fields is volatile. This has led to interest in ferroelectric Rashba semiconductors, which combine semiconductivity, large spin–orbit coupling and non-volatility. Here we report room-temperature, non-volatile ferroelectric control of spin-to-charge conversion in epitaxial germanium telluride films. We show that ferroelectric switching by electrical gating is possible in germanium telluride, despite its high carrier density. We also show that spin-to-charge conversion has a similar magnitude to what is observed with platinum, but the charge current sign is controlled by the orientation of ferroelectric polarization. Comparison between theoretical and experimental data suggests that the inverse spin Hall effect plays a major role in switchable conversion.

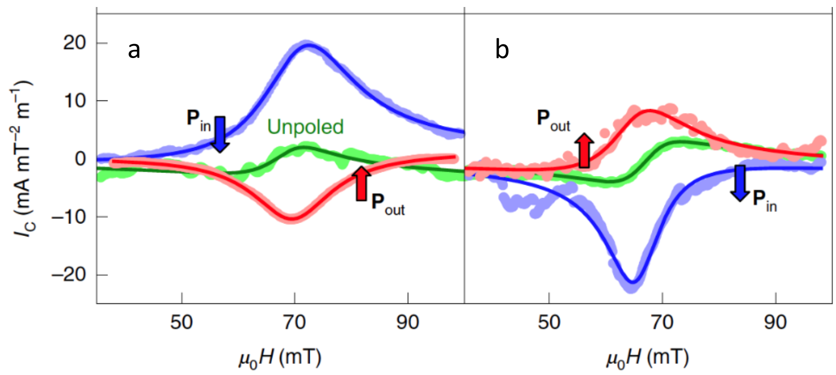

Fig. 1 Ferroelectric control of Spin-to-charge-conversion in GeTe. Normalized current production (a,b) versus magnetic field for a GeTe slab oriented along the ZA (a) and ZU (b) symmetry lines, for different ferroelectric polarizations. μ0 is the magnetic permeability in vacuum. The blue curves correspond to polarization P_{in} and red to P_{out}. The peak is positive (negative) for P_{in} and negative (positive) for P_{out}. The green curve refers to the pristine (unpoled) states.