Spintronic and quantized properties of magnetic topological insulator heterostructures

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Three-dimensional topological insulators are a prototypical topological material characterized by time-reversal symmetry, which supports a single Dirac fermion state on the surface of the insulating bulk. Upon introduction of magnetism, i.e. time-reversal symmetry breaking, such a surface Dirac electronic state exhibits extraordinary spin-related properties such as the quantum anomalous Hall effect and efficient magnetic controls via spin-orbit torques. We develop engineering ferromagnetic heterostructures of topological insulators with molecular beam epitaxy, allowing us to spatially control the surface ferromagnetism. First, I will show the magnetic proximity coupling [1] and its spintronic application [2] in ferromagnetic insulator/topological insulator systems. Second, in a magnetically doped/non-magnetic structure termed a "semi-magnetic" topological insulator, we demonstrate the half-integer quantization of anomalous Hall conductance associated with the quantum parity anomaly of 2D Dirac fermions by terahertz magneto-optical spectroscopy and electrical transport measurements [3].

[1] M. Mogi, T. Nakajima, V. Ukleev, A. Tsukazaki, R. Yoshimi, M. Kawamura, K. S. Takahashi, T. Hanashima, K. Kakurai, T. Arima, M. Kawasaki, Y. Tokura, Phys. Rev. Lett. 123, 016804 (2019).
[2] M. Mogi, K. Yasuda, R. Fujimura, R. Yoshimi, N. Ogawa, A. Tsukazki, M. Kawamura, K. S. Takahashi, M. Kawasaki, Y. Tokura, Nat. Commun. 12, 1404 (2021).
[3] M. Mogi, Y. Okamura, M. Kawamura, R. Yoshimi, K. Yasuda, A. Tsukazaki, K. S. Takahashi, T. Morimoto, N. Nagaosa, M. Kawasaki, Y. Takahashi, Y. Tokura, submitted.

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