Towards realistic modeling of proximitized magnetic topological insulator nanoribbons

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Proximitized magnetic topological insulator nanoribbons (PMTINRs) are a potential platform for the practical realization of the Majorana zero-energy mode (MZM) [1]. Here, we present a realistic description of PMTINRs and similar superconductor-topological insulator heterostructures. Both bulk and effective surface-state models are used to capture the low-energy electronic spectrum, with realistic parameters extracted from ab initio calculations. Using numerical simulations, we study in a tight-binding framework the properties of PMTINRs. Particular attention is given to the thin-film limit, where theoretical results have been conflicting on the topology of the hybridization gap. Magnetic and nonmagnetic disorder, as well as device imperfections, can all be detrimental to the formation of MZMs in PMTINRs. We aim to clarify what are the optimal conditions to obtain MZMs in PMTINRs, that are robust against such effects

References

[1] C.-Z. Chen, Y.-M. Xie, J. Liu, P. A. Lee, and K. T. Law, Phys. Rev. B 97, 104504 (2018).