Topological properties of multilayers and surface steps in the SnTe material class

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Surfaces of multilayer semiconductors typically have regions of flat terraces separated by atom-high steps. We investigate the properties of the low-energy states appearing at such atomic steps in Sn(Pb)Te(Se) [1]. We identify the important approximate symmetries and use them to construct the topological invariants. We calculate the dependence of mirror- and spin-resolved Chern numbers on the number of layers and show that the step states appear when these invariants are different on the two sides of the step. Since the density of states is large at the step the system is susceptible to different types of instabilities, and we consider an easy-axis magnetization as one realistic possibility. We show that magnetic domain walls support low-energy bound states because the regions with opposite magnetization are topologically distinct in the presence of nonsymmorphic chiral and mirror symmetries, providing a possible explanation for the zero-bias conductance peak observed in the recent experiment [2].

[1] W. Brzezicki, M. Wysokinski, and T. Hyart, *arXiv:1812.02168*
[2] G. P. Mazur, K. Dybko, A. Szczerbakow, M. Zgirski, E. Lusakowska, S. Kret, J. Korczak, T. Story, M. Sawicki, and T. Dietl, *arXiv:1709.04000*