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Microscopic study of anomalous Hall effect edge states in topological insulator nanoribbons CARLO M. CANALI, ANNA PERTSOVA, Linnaeus University, ALLAN H. MACDONALD, The University of Texas at Austin — Thin films of a magnetic topological insulator (TI) support gapless chiral states on their lateral surfaces, which give rise to the quantum anomalous Hall effect (QAHE) [1,2]. Despite progress in the experimental realization of the QAHE there are many open issues which require an explanation, including remnant longitudinal resistance and relatively imprecise Hall quantization compared to the ordinary QHE in a strong perpendicular magnetic field. These features can be linked to the presence of non-chiral dissipative states on the side walls of the sample. We develop a microscopic theory of side-wall states in ribbons of a magnetic TI. We show the emergence of the chiral edge states as a function of exchange field strength and ribbon width. We demonstrate the existence of non-chiral edge states, whose number depends on the system dimensions. In contrast to previous work [3], we find that the non-chiral states are always gapped, a finding which is supported by recent experiments assessing the precision and temperature dependence of QAHE [4]. Finally, we investigate the role of chemical disorder in equilibrating edge channels and in Hall quantization accuracy. 1.Yu, Science 329, 61(2010); 2.Chang, Science 340, 167(2013); 3.Wang, PRL 111, 086803(2013); 4.Chang, PRL 115, 057206(2015).

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