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Magnetic field dependence of the edge channels in HgTe quantum wells[1] BENEDIKT SCHARF, ALEX MATOS-ABIAGUE, JAROSLAV FABIAN, Institute for Theoretical Physics, University of Regensburg, 93040 Regensburg, Germany — In recent years much attention has been devoted to topological insulators, that is, materials which are insulating in the bulk, but have conducting states at their surface. This new class of topological states has first been observed experimentally in HgTe quantum wells. In such a two-dimensional topological insulator, which is also synonymously referred to as a quantum spin Hall insulator, these surface states are one-dimensional, helical edge channels. Here we study a HgTe quantum well in the presence of a constant perpendicular magnetic field. Using tight-binding calculations as well as deriving an analytical expression to determine the electron dispersion and states, we solve the effective low-energy Hamiltonian of this system in a finite-strip geometry. Our main focus is on the behavior of these solutions with increasing magnetic field. In particular, we describe the evolution of the edge states as the system crosses from the quantum spin Hall to the quantum Hall regime.

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