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Probing topological transitions in HgTe/CdTe quantum wells by magneto-optical measurements[1] BENEDIKT SCHARF, ALEX MATOS-ABIAGUE, Department of Physics, SUNY at Buffalo, JAROSLAV FABIAN, Institute for Theoretical Physics, University of Regensburg, IGOR ZUTIC, Department of Physics, SUNY at Buffalo — In two-dimensional topological insulators, helical Quantum Spin Hall (QSH) states persist even at finite magnetic fields below a critical magnetic field B_c, above which only Quantum Hall (QH) states can be found [1]. Using linear response theory, we theoretically investigate the magneto-optical properties of inverted HgTe/CdTe quantum wells, both for infinite two-dimensional and finite-strip geometries, and possible signatures of the transition between the QSH and QH regimes. In the absorption spectrum, several peaks arise due to non-equidistant Landau levels in both regimes. However, in the QSH regime, we find an additional absorption peak at low energies in the finite-strip geometry. This peak arises due to the presence of edge states in this geometry and persists for any Fermi level in the QSH regime, while in the QH regime the peak vanishes if the Fermi level is situated in the bulk gap. Thus, by sweeping the gate voltage, it is potentially possible to distinguish between the QSH and QH regimes. Moreover, we investigate the effect of spin-orbit coupling and finite temperature on this measurement scheme.

[1] B. Scharf, et al., Phys. Rev. B 86, 075418 (2012).

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