Dirac Fermions in HgTe Quantum Wells

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Narrow gap HgTE quantum wells exhibit a band structure with linear dispersion at low energies and thus are very suitable to study teh physics of the Dirac Hamiltonian in a solid state system. In comparison with graphene, they boast higher mobilities and, moreover, by changing the well width one can tune the effective Dirac massfrom positive, through zero, to negative.

Negative Dirac mass HgTe quantum wells are 2-dimensional topological insulators and, as a result, exhibit the quantum spin Hall effect, where a pair of spinfull helical edge channels develops when the bulk of material is insulting, leading to a quantized conductance.

In this talk, I will give an overview of our recent work on the quantum spin Hall effect that develops when the HgTe samples are gated into the gap, as well as the Dirac Fermion physics we observe when the wells are metallic.