

Spin Hall effects in HgTe Quantum Well Structures

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Spin-orbit interaction (SOI) in 2DEGs causes many interesting and potentially useful effects, such as the generation of an intrinsic spin accumulation polarized normal to the 2DEG at the edges, caused by the presently very topical spin-Hall effect [1]. So far no direct evidence for the intrinsic SHE has been obtained by transport experiments. Here, we demonstrate that in specially designed nanostructures [2], which are based on narrow gap HgTe type-III quantum wells (QW), a detection of the spin signal is possible via voltage measurements.

Recently, it was pointed out that inverted HgTe QW structures can be regarded as non-trivial insulators[3], in which the quantum spin Hall insulator state[4] should occur. In this state, a pair of spin polarized helical edge channels develops when the bulk of the material is insulating, leading to a quantized conductance. We will discuss our recent transport measurements on gated low density HgTe QWs that yield a first evidence for the existence of this effect.

[1] S. Murakami et al., Science 301 (2003) 1348;

J. Sinova et al., Phys. Rev. Lett. 92 (2004) 126603;

Y. Kato et al., Science 306 (2004) 1910 .

[2] E.M. Hankiewicz, et al., Phys. Rev. B 70 (2004) 241301(R)

[3] B.A. Bernevig et al., Science 314 (2006) 1757

[4] C.L. Kane and E.J. Mele, Phys. Rev. Lett. 95 (2005) 146802.