Pressure studies of transition from topological insulator into Anderson topological insulator in HgTe quantum well

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One important point in the physics of two-dimensional topological insulators (2DTI) [1] is the unknown role of trivial, i.e., non-helical edge channels that may exist in HgTe QWs, together with the helical ones [2]. They are a result of band bending at the outer edge caused by surface states and/or by contamination by impurities. In the recent work Ma et al. [3] the assume the existence of trivial channels to explain results of microwave impedance microscopy measurements on HgTe QWs. On the other hand, the main evidence against a contribution of the trivial channels in 2DTI is a very high resistance in the wells of the thickness smaller than the critical value, $d < d_c$, i.e., those of direct band structure [1].

In order to resolve this ambiguity we perform new studies of nonlocal resistance of the edge channels in HgTe QW with d = 7.1 nm at different hydrostatic pressures up to 3.6 kbar. Because the pressure would induce a transition between 2DTI and trivial insulator phases [4], one expects the disappearance of nonlocal transport along helical channels, but not via trivial channels. However, we have found that the pressure causes a substantial decrease of the electron mobility, indicating severe deterioration of the sample. Despite of this, a clear edge transport is preserved. This may point to the appearance of a newly predicted Anderson topological insulator phase in our sample [5]. Furthermore, the nonlocal transport vanishes in high magnetic field values strongly dependent on the pressure, the finding in agreement with results of theoretical calculations within the 8-band *kp* model for topological states. Thus our results can consistently be explained by the presence of topological edge channels though the role of pressure-induced defects has to be elucidated.

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