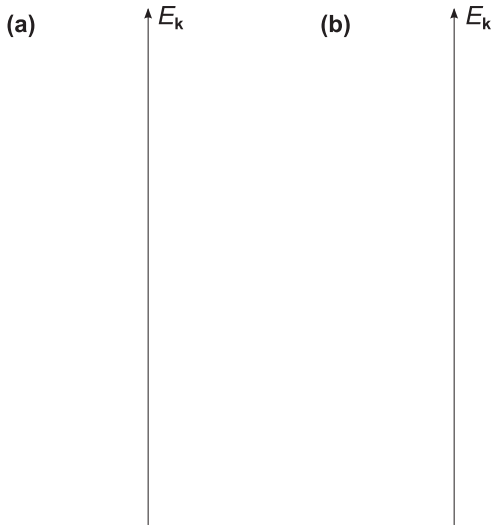
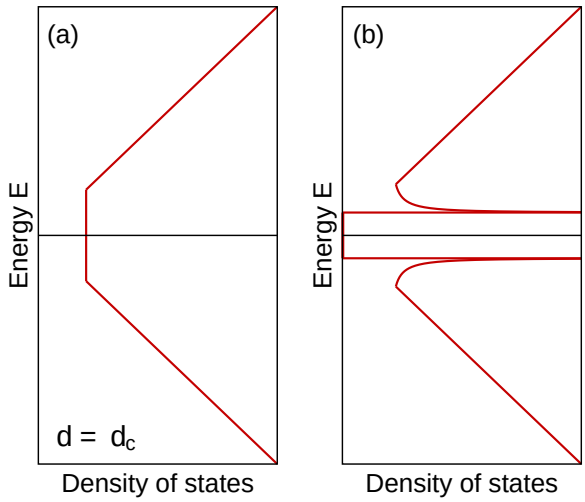

(a)
E_k
(b)
E_k


(a)
Energy E
d = d_c
Density of states
(b)
Energy E
Density of states

energy spectrum. Such a behavior is dictated by the selection rules and energy conservation law: Direct optical transitions in QWs of critical thickness are allowed only between the branches 1 3 and 2 4 and these transitions can occur at 2| |. In QWs of noncritical thickness [Fig. 5(b)], the branches 2 and 3 anticross at a Þnite wave vector, and direct optical transitions between them become allowed. It leads to the emergence of an additional sharp band in the absorption spectrum at = 2| |. The spectral shape of this absorption band is determined by the van Hove singularities in the density of states.

To summarize, we have described the splitting of Dirac states in HgTe/CdTe quantum wells of critical and close-to-critical thicknesses. In structures of critical thickness, the splitting between the Dirac cones reaches a value of 15 meV and is dominated by symmetry-enforced light-hole–heavy-hole mixing at the quantum well interfaces. These structures behave as a two-dimensional semimetal with a nonvanishing density of states in the whole energy range. In quantum wells of close-to-critical thicknesses, a gap opens at a Þnite in-plane wave vector, which leads to the emergence of extremum circles in the electron dispersion and corresponding van Hove singularities in the density of states. We have also discussed the consequences of level mixing on the optical and transport properties that await testing.

Financial support by the RFBR, RF President Grants No. MD-3098.2014.2 and No. NSh-1085.2014.2, EU project SPANGL4Q, and the ÒDynastyÓ Foundation is gratefully acknowledged. Work at the University of Colorado, Boulder by A.Z. was supported by the US Department of Energy, Office of Science, Basic Energy Science, Materials Sciences and Engineering Division under Contract No. DE-FG02-13ER46959 to the University of Colorado.

[1] M. Z. Hasan and C. L. Kane, Rev. Mod. Phys. 82, 3045 (2010).
[2] X.-L. Qi and S. C. Zhang, Rev. Mod. Phys. 83, 1057 (2011).
[3] Y. Xia, D. Qian, D. Hsieh, L. Wray, A. Pal, H. Lin, A. Bansil, D. Grauer, Y. ,APrso GrR.6(.)-2440 l oJ.6(.)-24406(C)-.5(6)20.3(v)1521(and,2440 l od)-25028(a)M.5(.)-24806(C)Z.4(s)