

## Pressure tuning of THz cyclotron resonance in HgCdTe alloys

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The main inspiration of the current work was the results previously obtained by the part of the co-authors in MCT samples by temperature-dependent THz magnetospectroscopy [1]. The latter revealed the evolution of the energy band-gap with temperature vanishing at a certain temperature. It was shown that although the fermions in MCT alloys are represented by the admixture between the Dirac and spin-1 particles [2], they indeed support the pseudo-relativistic description involving the particle rest-mass and Fermi velocity. This work focuses on the band-gap evolution of Hg<sub>1-x</sub>Cd<sub>x</sub>Te epitaxial alloys with cadmium content ( $x$ ) and the hydrostatic pressure ( $p$ ) probed by THz magnetospectroscopy. We study three MCT samples with different cadmium content  $x = 0.15, 0.16$  and  $0.17$ . THz magnetospectroscopy of the sample with  $x = 0.15$  was performed in the pressure cell in the range of  $p$  from 0 to 3.83 kbar.

The THz magnetospectroscopy was performed at 2 K using thinned Allan-Bradley carbon resistor as a bolometer. As a source of THz radiation, the far-infrared molecular laser and Virginia diodes (VDI) source operating at 0.63 THz, 1.61 THz, 1.84 THz, 2.52 THz, 3.11 THz, and 4.25 THz were used. To create hydrostatic pressure in the pressure cell a mixture of transformer oil and kerosene was used. The fitting analysis agrees with experimental results and pseudo-relativistic description with Fermi velocity  $c = 1.0 \cdot 10^6$  m/s independent of hydrostatic pressure  $p$  and Cd content  $x$ .

We have investigated THz magnetospectroscopy of pseudo-relativistic fermions in Hg<sub>1-x</sub>Cd<sub>x</sub>Te alloys with different cadmium content. The measured transmission spectra have featured resonant absorption lines corresponding to the optical transition between Landau levels of pseudo-relativistic fermions. Analysis of experimental data within the pseudo-relativistic description [1] allowed us to determine the rest mass  $m$  and Fermi velocity  $c$  of pseudo-relativistic fermions. The band-gaps  $E_g = 2mc^2$  are in good agreement with the previously measured dependence on Cd content. The values of  $c$  are shown to be independent of Cd content and hydrostatic pressure.

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### Reference:

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- [2] S.S. Krishtopenko et al. "Hybridization of topological surface states with a flat band" J. Phys.: Condens. Matter 32, 165501 (2020).

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