Contribution ID : **39** Type : **Oral presentation**

Pressure tuning of THz cyclotron resonance in HgCdTe alloys

Wednesday, 6 July 2022 11:45 (20)

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 Hg1-xCdxTe 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 = 1.0·106 m/s independent of hydrostatic pressure p and Cd content x.
We have investigated THz magnetospectroscopy of pseudo-relativistic fermions in Hg1-xCdxTe 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 Eg = 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.

This research was partially supported by the Foundation for Polish Science through a TEAM/2016-3/25 and by CENTERA Laboratories in the frame the International Research Agendas program for the Foundation for Polish Sciences co-financed by the European Union under the European Regional Development Fund (No. MAB/2018/9). It was also supported by the Terahertz Occitanie Platform, by CNRS through IRP.

Reference:
[1] F. Teppe et al. “Temperature-driven massless Kane fermions in HgCdTe crystals” Nature Comm. 7, 12576 (2016).
[2] S.S. Krishtopenko et al. “Hybridization of topological surface states with a flat band” J. Phys.: Condens. Matter 32, 165501 (2020).

Primary author(s) : SZOŁA, Maria (Institute of High Pressure Physics PAS; Laboratoire Charles Coulomb, UMR, CNRS); Mr IVONYAK, Yurii (CENTERA Laboratories, Institute of High Pressure Physics PAS, Warsaw, Poland); Dr PRZYBYTEK, Jacek (CENTERA Laboratories, Institute of High Pressure Physics PAS, Warsaw, Poland); Dr MIKHAILOV, N, N, (2 Rzhanov Institute of Semiconductor Physics SB RAS); Prof. DVORETSKY, S (2 Rzhanov Institute of Semiconductor Physics SB RAS); Dr TEPPE, Frederic (UMR, CNRS); Prof. KNAP, Wojciech (CENTERA Laboratories, Institute of High Pressure Physics PAS, Warsaw, Poland)

Presenter(s) : SZOŁA, Maria (Institute of High Pressure Physics PAS; Laboratoire Charles Coulomb, UMR, CNRS)

Session Classification : Wed 06/07 Morning 2/ change at 11 o’clock keynote1 J.M Klopf / Abstract ID