Terahertz spectroscopy of topological insulators

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Knowing the band structure of materials is one of the prerequisites to understand their properties. Therefore, angle-resolved photoemission spectroscopy (ARPES) has become a highly demanded experimental tool to investigate the band structures. However, especially in thin film materials with a layered structure and several capping layers, access to the electronic structure by ARPES is limited.

Here, we directly invert the results by cyclotron resonance experiments to obtain the band structure of a two-dimensional (2D) material. This procedure is applied to the mercury telluride quantum well with critical thickness which is characterized by a 2D electron gas with linear dispersion relations. The Dirac-like band structure in this material could be mapped and analyzed both on the electron and on the hole side of the band diagram. In this material, purely linear dispersion of the hole-like carriers encounters substantial quadratic corrections for the electrons.

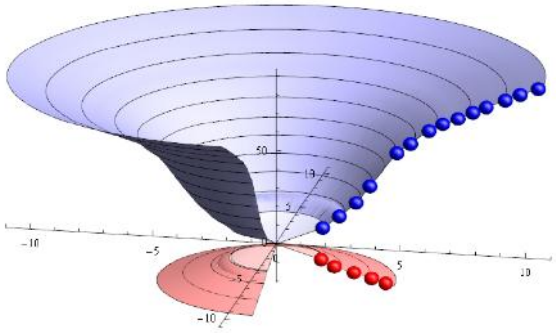

Figure. Mapping the band structure of a 2D Dirac cone in HgTe using the cyclotron resonance experiments.

References

[1] In cooperation with: A. Shuvaev, V. Dziom, N. N. Mikhailov, Z. D. Kvon, Y. Shao, D. N. Basov