# Finding Weyl/Dirac fermions by optical and magneto-optical spectroscopy

David Santos-Cottin[1], Jan Wyzula[2], Iris Crassee[2], Florian Le Mardelé[1], Edoardo Martino[1, 3], Gaku Eguchi[4], Filip Orbanić[5], Mario Novak[5], Milan Orlita[2], Ana Akrap[1]

*[1] Department of Physics, University of Fribourg, 1700 Fribourg, Switzerland*
*[2] LNCMI, CNRS-UGA-UPS-INSA, 25, avenue des Martyrs, 38042 Grenoble, France*
*[3] Institute of Condensed Matter Physics, Ecole Polytechnique Fédérale de Lausanne, 1015 Lausanne, Switzerland*
*[4] Institute of Solid State Physics, Vienna University of Technology, Wiedner Hauptstrasse, Vienna, Austria*
*[5] Department of Physics, Faculty of Science, Zagreb, Croatia*

Recently discovered Weyl semimetals are a new class of topological materials with low energy excitations described by the Weyl equation. Exotic properties may emerge due to this 3D linear band dispersion in momentum space. The bands cross near the Fermi level at a point called the Weyl node. For symmetry reasons, these bands are non-degenerate and the Weyl nodes appear in pairs of opposite chirality.

TaAs has a complex Fermi surface composed of two Weyl pockets and one trivial hole pocket [1], and it is not evident how to describe the low energy excitations [2,3,4]. In order to reveal the details of the low energy electronic band structure of TaAs, we measured two samples of TaAs with two different crystal orientations, and slightly different Fermi levels. The main experimental technique we use is optical spectroscopy, both in zero and in high magnetic field (up to 34 T). This is complemented by magnetotransport measurements up to 14 T. In a finite magnetic field, Landau level transitions dominate the optical spectra and clearly show whether or not the band dispersion is linear. Depending on the Fermi level and orientation, we observe both massless and massive dispersion in TaAs. Our measurements provide an estimate of the energy scale of the Weyl dispersion in TaAs.

[1] B. Lv *et al*. PRX **5,**011029 (2015).
[2] S. Kiruma *et al*. PRB **96**, 075119 (2017).
[3] B. Xu *et al*. PRB **93**, 121110(R) (2016).
[4 ]B. Lv *et al*. Nat. Phys. **11**, 724 (2015).