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Suppressed magnetic circular dichroism and valley-polarized magnetoabsorption due to the mass anisotopy in Bi

ALEXEY B. KUZMENKO, University of Geneva

We measure broadband far-infrared magneto-optical conductivity spectra of pure bismuth separately for left- and right-handed circular polarizations in magnetic fields up to 7 T that allows us to obtain the magnetic circular dichroism (MCD). Thanks to a high spectral resolution we distinguish the Landau level (LL) transitions in the Dirac-like electron and the parabolic hole bands. The hole transitions exhibit a full (100%) MCD as is indeed expected for a circular cyclotron orbit. However, the MCD for electron-pocket transitions is reduced to only 13±1%. This strong suppression can be attributed to the huge effective-mass anisotropy ($\sim$ 200) in the electron pockets and can be generally interpreted as a signature of the mismatch between the spatial metric experienced by the photons and the electrons. An important consequence of this observation is that the magneto-absorption in bismuth is highly valley sensitive, which paves the way to future valleytronic applications in materials with a strong effective-mass anisotropy. [1] P.J. de Visser, J. Levallois, M.K. Tran, J.-M. Poumirol, I.O. Nedoliuk, J. Teyssier, C. Uher, D. van der Marel, and A. B. Kuzmenko, Phys. Rev. Lett. **117**, 017402 (2016).