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Optical properties of two-dimensional charge density wave materials CHARLES SAYERS, University of Bath, SARA KARBASSI, SVEN FRIEDEMANN, University of Bristol, ENRICO DA COMO, University of Bath — Titanium diselenide ($TiSe_2$) is a member of the layered transition metal dichalcogenide (TMD) materials. It exhibits unusual chiral charge ordering below 190 K after undergoing an initial phase transition to a commensurate (2 x 2 x 2) charge density wave (CDW) at 200 K which is enhanced further in the monolayer [1]. Recently, the first evidence of chirality in a CDW system was discovered in this material by scanning tunneling microscopy and time-resolved reflectivity experiments, where separate left and right handed charge-ordered domains were found to exist within a single sample [2]. We have prepared single crystals of 1T-$TiSe_2$ using iodine vapour transport, and confirmed their quality by x-ray analysis and charge transport measurements. Using a combination of polarised optical spectroscopy techniques in the mid to far infrared (4 to 700 meV photon energy), we have measured an anisotropy relating to the CDW gap. We discuss the results on the basis of chiral domains with different handedness and the nature of the CDW transition.

[1] P. Chen et al. Charge density wave transition in single-layer titanium diselenide. Nature Communications, 6:8943, (2015).
[2] J. Ishioka et al. Chiral charge-density waves. Physical Review Letters, 105(17):176401, (2010).

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