Canadian Association
of Physicists

Association canadienne
des physiciens et physiciennes

Contribution ID: **2640** Type: **Oral not-in-competition (Graduate Student) / Orale non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

Optical second harmonic susceptibility in the Weyl semimetal tungsten telluride

Wednesday 5 June 2019 11:45 (15 minutes)

A recent study on the Weyl semimetal tantalum arsenide showed that it has an unusually large second-order nonlinear optical susceptibility [1]. Subsequently, models that connect the band-structure geometry and the nonlinear susceptibility were established to explain this anomaly [2],[3]. Here we study second harmonic generation (SHG) in another acentric semimetal, tungsten telluride (WTe₂), and measured its nonlinear second-order nonlinear optical susceptibility χ⁽²⁾.

WTe₂ has an orthorhombic crystal structure with C_{2v} point group symmetry. It is a layered material that has a natural cleavage plane perpendicular to the *c-axis*, but lacks optical-quality facets along its edges. However, for light at normal incidence, the constraints imposed by crystal symmetry imply that SHG is observable only for light reflected from the edges of the crystal, not from the natural planar surface. Hence, we measure the SHG in a confocal microscope, where it is easier to measure the second harmonic generation from the striated edges of the crystal. For the same illumination conditions, we find that the SHG intensity from GaAs and WTe₂ are comparable, which suggests that the χ⁽²⁾ of WTe₂ is comparable to or greater than that of GaAs. We also compare our results to theoretical calculations that predict the second-order nonlinear response of various Weyl semimetals [3].

1. Wu, L. et al., Giant anisotropic nonlinear optical response in transition metal monopnictide Weyl semimetals, *Nat. Phys.* **13,** 350-355 (2017).
2. Patankar, S. et al., Resonance-enhanced optical nonlinearity in the Weyl semimetal TaAs, *Phys. Rev. B* **98,** 165113 (2018).
3. Zhang, Y. et al., Berry curvature dipole in Weyl semimetal materials: An *ab initio* study, *Phys. Rev. B* **97,** 041101 (2018).

Author: LOPEZ.L, Leya (Department of Physics, Simon Fraser University, Canada)

Co-authors: KAMAL, Saeid (Department of Chemistry, University of British Columbia, Canada); MUN, Eundeok (Department of Physics, Simon Fraser University, Canada); DODGE, J. Steven (Department of Physics, Simon Fraser University, Canada)

Presenter: LOPEZ.L, Leya (Department of Physics, Simon Fraser University, Canada)

Session Classification: W1-8 Probing and controlling matter with light II (DCMMP) | Sonder et contrôler la matière avec de la lumière II (DPMCM)

Track Classification: Condensed Matter and Materials Physics / Physique de la matière condensée et matériaux (DCMMP-DPMCM)