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Extraction of higher-order nonlinear electronic response in solids using high harmonic generation LISA ORTMANN, Ohio State University, S. HAN, University of Central Florida, H. KIM, Y. KIM, Korea Advanced Institute of Science and Technology, T. OKA, Max Planck Institute for the Physics of Complex Systems, A. CHACON, Los Alamos National Laboratory, B. DORAN, University of Oxford, M. CIAPPINA, ELI-Beamlines, M. LEWENSTEIN, Institut de Ciencies Fotoniques, S.-W. KIM, Korea Advanced Institute of Science and Technology, S. KIM, Pusan National University, A. S. LANDSMAN, Ohio State University — Nonlinear susceptibilities are key to ultrafast lightwave driven optoelectronics, allowing petahertz scaling manipulation of the signal. Recent experiments[1] retrieved a 3rd order nonlinear susceptibility by comparing the nonlinear response induced by a strong laser field to a linear response induced by the otherwise identical weak field. The highly nonlinear nature of high harmonic generation has the potential to extract even higher order nonlinear susceptibility terms. However, up till now, such characterization has been elusive due to a lack of direct correspondence between high harmonics and nonlinear susceptibilities. We demonstrate[2] a regime where such correspondence can be clearly made, extracting nonlinear susceptibilities from sapphire of the same order as the measured high harmonics. The extracted high order susceptibilities show angular-resolved periodicities arising from variation in the band structure with crystal orientation. Our results open a door to multi-channel signal processing, controlled by laser polarization.

[1]A. Sommer et al., Nature **534**, 8690 (2016).
[2]S. Han, L. Ortmann, H. Kim et al., Nat. Comm. **10**, 3272 (2019).

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