

Probing chirality with high-harmonic generation

Jessica O. de Almeida

Mathias S. Scheurer

Institute for Theoretical Physics III, University of Stuttgart, 70550 Stuttgart, Germany

jessica.almeida@itp3.uni-stuttgart.de

Abstract

Over the past decades, the study of electronic behavior in novel materials has gained significant attention, driven by both the miniaturization of technology and the discovery of quantum effects at micro- and nanoscale dimensions. These quantum properties can be probed through high-harmonic generation (HHG), a nonlinear process arising from the interaction of a strong laser field with matter. HHG provides access to intrinsic material properties, such as the electronic wave function, enabling the characterization of topological phases and electronic velocities.

HHG has proven to be sensitive to topological phases, as well as to other phenomena including superconductivity, metallic behavior, and interaction-induced insulating phases. Previous studies have shown how topological invariants, such as the Chern number, can be extracted from an experimentally measurable quantity, the circular dichroism in HHG. This quantity is obtained by comparing the response of the system under different laser polarizations. For instance, the Chern number has been computed in the prototype Chern insulators, such as the Haldane model.

In this work, we extend these ideas to two-dimensional correlated van der Waals multilayer systems. Specifically, we exploit the nonlinear coupling between material chirality and laser polarization to test the use of circular dichroism in HHG as a measure of the Chern number in these materials.