Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

All-optical characterization of a topological phase transition via circular dichroism in HHG. ALVARO JIMENEZ-GALAN, Max Born Institute, RUI SILVA, Universidad Autonoma de Madrid, BRUNO AMORIM, Universidade do Minho, OLGA SMIRNOVA, MISHA IVANOV, Max Born Institute — Quantum materials encompass a rich variety of systems with fascinating features. One of them is the topological phase transition, upon which an insulator becomes conducting, supporting robust currents around the insulator's edges. So far, the ultrafast dynamics of non-equilibrium electronic response to intense optical fields in these materials has remained virtually unexplored. Yet, understanding these dynamics is not only fundamentally interesting, it is also crucial for light-wave electronics in topological materials. Attosecond science has made major progress in understanding ultrafast electron dynamics in solids. Yet, the role of properties such as the Berry curvature and topological invariants on the attosecond dynamics of electronic response has been hardly explored. Does the highly non-equilibrium electron dynamics in the bulk, driven by a strong laser field, encode topological information on the sub-laser cycle time-scale? In this talk, I will answer this question using the paradigmatic example of the topological insulator, the Haldane system. I will demonstrate how the topological phase transition can be tracked all-optically by a linearly polarized field using polarization-resolved HHG, or by two circularly-polarized fields from the HHG spectrum, and I will illustrate how the ellipticity of the pulses influences this detection. I will further show that the highly nonlinear optical response to strong fields, the high harmonic emission, displays topologically-dependent attosecond delays.

Alvaro Jimenez-Galan
Max Born Institute

Date submitted: 03 Feb 2020 Electronic form version 1.4