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## Symmetry and chirality in high harmonic generation and ultrafast spectroscopy

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### Abstract

The analysis of symmetries and their associated selection rules is extremely useful in many fields of science. In this respect, the field of nonlinear optics is no exception, where symmetries are used to derive whether particular nonlinear optical processes are allowed or forbidden according to the medium's point-group. This approach is believed to be complete, and is regularly taught in graduate classes. I will present a more general (and closed-form) group-theory analysis for the role of symmetries in light-matter interactions. Within this approach, both the symmetries of the nonlinear medium (gas, liquid, or solid), and the dynamical symmetries of the incident laser field, are fully taken into account. The theory leads to many new symmetries and selection rules in light-matter interactions that are useful for a variety of applications, e.g. controlling the properties of extreme UV light in high harmonic generation (HHG). I will also discuss the role of symmetry and symmetry-breaking in high harmonic spectroscopy. Specifically, I will focus on ultrafast detection of chirality and atomic and molecular ring-currents, where we have recently made progress. Lastly, I will show that using the dynamical symmetry group-theory allows defining new intrinsic chirality properties for light, which may pave the way for novel concepts in electromagnetism and chiral light-matter interactions.

ההרצאה תתקיים ביום רביעי, ה-8.7.2020 בשעה 12:30  
דרך זום: [קישור](#)

The lecture will take place on Wednesday, 8.7.2020 at 12:30  
via zoom: [link](#)

<https://technion.zoom.us/j/93373033544>

Ph.D. Student of Professor Oren Cohen