Inelastic light scattering from disordered crystals

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In past several years my group investigated the structural dynamics of halide, oxide and sulfide perovskites crystals by means of Raman scattering. The structural dynamics of the perovskite crystals is fascinating because they exhibit a plethora of anharmonic effects such as soft modes, order-disorder phase transitions and local fluctuations. Such effects have significant implications on the electronic properties (*e.g.* dielectric response, carrier lifetimes and carrier mobilities) of the crystals, especially at finite temperatures where these properties are invariably truly relevant. Importantly they may lead to relaxation of the symmetry-based selection rules for Raman scattering. On one hand, the resulting Raman spectra are difficult to interpret, on the other, they are rich in information regarding the crystal properties.

In this talk, I will review our journey to unlock the mysteries of perovskite structural dynamics, using Raman spectra. First, I will demonstrate and discuss a common discrepancy between x-ray diffraction data showing perfect single crystals and Raman data showing disorder. Next, I will explain how we use generalized models of scattering to settle this discrepancy. Finally, I will show that the intensity of the scattered light, which is an underused experimental observable, can be utilized to learn much regarding crystal properties such as dielectric response.