Dielectric Solvation of Band Edge Carriers in Lead-Halide Perovskites

I will present and discuss recent data where we observe strongly temperature dependent Stokes shift in the electronic spectra of both hybrid and inorganic lead-halide perovskites. This behavior is distinct from other crystalline semiconductors. Standard solid state semiconductor physics fail to reproduce the temperature dependence. Dielectric solvation theories, originally developed for liquid phase molecular photophysics and chemistry, capture the experimental observation well. The efficacy of dielectric solvation theory indicates the break-down of quantized harmonic phonon picture in lead-halide perovskites. Instead of being stablized by harmonic phonon quanta, electronic excited states are solvated by the dielectric response from an anharmonic vibrational continuum. Similarities between hybrid and inorganic lead-halide perovskites show organic cations are neither a crucial nor a necessary component for dielectric solvation of charge carriers. The dielectric response is provided by the general perovskite framework normal modes.