Seminar 3 March

Abstract:

For thin-film solar cells, assuming adequate band-alignment, the distribution of defect states within the absorber material and its interfaces will govern the final opto-electronic quality of the absorber and ultimately determine final device performance.

Quantitatively characterizing defect distributions in as-prepared metal halide perovskite (MHP) thin films remains a significant challenge, as evidenced, for example, by the lack of a general consensus for which defect distributions are commonly present in perovskite systems or which atomic structures are responsible for non-radiative recombination. This difficulty arises in part from the strong sensitivity of MHPs to synthesis conditions and procedures, leading to a broad range of emergent as-prepared films, resulting in a wide range of optoelectronic properties. Furthermore, under continuous external stressors such as heat, moisture, bias, and light, MHP materials undergo various (ir)reversible chemical and structural changes. These processes further modify defect distributions, complicating efforts to reliably characterize recombination-active defects and their evolution over time.

In this presentation, we demonstrate how tracking carrier dynamics, such as time resolved photoluminescence (trPL) or time resolved surface photovoltage (trSPV) measurements, can serve as an indirect probe of defect distributions within MHP thin films. We will showcase results and limitations of trPL and trSPV seperately, discuss the capabilities and limitations of each technique, and present first results on the correlation of both measurements