

PHYSICAL CHEMISTRY SEMINAR

Wednesday, February 7, 2024

10:30-11:30 a.m. BRWN 4102

"Tracking Charge and Spin in Time and Space in Halide Perovskites"

Sascha Feldmann, Ph.D.

Research Group Leader & Rowland Fellow
at Harvard University

Tenure-Track Assistant Professor in Physical Chemistry
& Head of the Laboratory for Energy Materials at EPFL



Abstract:

Halide perovskites are promising semiconductors for next-generation optoelectronic and spintronic applications. Yet, we still don't fully understand what governs the charge and spin dynamics in these materials. This is especially true when studying device-relevant thin films of halide perovskites, which lack single-crystalline perfection.

In this talk, I will give an overview of our recent efforts to understand the spin-optoelectronic performance of these films better by using time-, space- and polarization-resolved spectroscopy and microscopy. We will find that the energetically heterogeneous energy landscape in mixed-halide perovskites can lead to the local accumulation of charges, with unexpected consequences for devices [1]; how despite strong differences in vertical diffusivity and across grains charge extraction can remain very efficient [2], and how locally varying degrees of symmetry-breaking drive spin domain formation [3,4] in this fascinating class of solution-processable semiconductors.

Time permitting, I will conclude with briefly explaining the fundamentals and artifacts involved in measuring circularly polarized luminescence (CPL) reliably [4,5], and finally, time permit, show our most recent development of full Stokes-vector polarimetry with unprecedented time- and polarization resolution to track the emergence of chiral light emission.

[1] Nature Photonics 14, 123 (2020)

[2] Nature Materials 21, 1388 (2022)

[3] Nature Materials 22, 977 (2023)

[4] Nature Reviews Materials 8, 365 (2023)

[5] Advanced Materials 35, 2302279 (2023)



Department of Chemistry