



# Origins of Delayed Recombination and Halide Segregation in Metal Halide Perovskites\*

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The origin of the long carrier lifetimes in metal-halide perovskites observed at low photoexcitation carrier densities is a hotly debated topic. To date, a variety of mechanisms have been proposed explaining this behavior including: polaron formation, long-lived trap states, as well as the direct-indirect nature of the bandgap, which has been attributed to the Rashba effect. However, the Rashba effect requires the breaking of the centrosymmetric  $I4/mcm$  space group, which is a subject of considerable disagreement in the community. We have recently probed the space group of room temperature tetragonal  $\text{MAPbI}_3$  using second harmonic generation rotational anisotropy (SHG-RA). In this seminar, I will discuss a combination of the SHG-RA measurements, first principles density functional theory calculations, and analytical van Roosbroeck-Shockley calculations to investigate the implications the Rashba effect may have on the radiative lifetime of perovskites. I will also discuss photo-induced halide segregation, a phenomenon that has been put forward as a potential cause of the reduced performance of wide bandgap, mixed-halide perovskites for tandem solar cells.

**Kyle Frohna** is currently a visiting researcher working with Samuel D. Stranks in the Cavendish Laboratory at the University of Cambridge. He recently completed his undergraduate degree in Nanoscience and Materials Science at Trinity College, Dublin.