

Low temperature photoexcitation dynamics in triple cation lead halide perovskites

Alexander Schauerte¹, Isabel Allegro², Anton Krüger¹, Martin Koch¹, Ian Howard², Uli Lemmer², Marina Gerhard¹

¹Department of Physics and Marburg Centre for Quantum Materials and Sustainable Technologies, Marburg, Germany. ²Light Technology Institute, Karlsruhe Institute of Technology, Karlsruhe, Germany

Abstract

We study the recombination dynamics of triple cation lead halide perovskites using time resolved photoluminescence (PL) spectroscopy. Three different phase-stable thin film samples with slightly non-stoichiometric ratios of the lead and halide cations are compared, which presumably induce different amounts of static disorder, becoming apparent in different PL linewidths at low temperatures. We observe two distinct temperature regimes, which could originate from the increasing influence of dynamic disorder in the perovskite lattice at higher temperatures, due to the strong electron-phonon coupling in these systems. Our analysis of the emission spectra indicates that a certain amount of static disorder could even be beneficial for applications as light emitters or CW lasing.