Title:	Design, Synthesis and Ultrafast Charge Carrier Dynamics in Perovskites
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Abstract:	Abstract Solar energy is the most promising renewable energy source alternative to traditional sources derived from fossil fuels. Solar cells are designed based on the principle of the photoelectric effect where the absorbed light is converted into electrical energy through the generation of free charge carriers (electrons and holes). Thus, an understanding of the generation and relaxation dynamics of these charge carriers lies at the heart of designing efficient materials for photovoltaic applications. Ultrafast spectroscopy, using femtosecond laser pulses at optical frequencies, has been a quintessential technique for probing the dynamics of such photogenerated charge carriers. This thesis is focused on the design, synthesis, and ultrafast charge carrier dynamics of perovskites, which emerged as one of the most promising candidates for efficient light-harvesting (and charge conduction) in solar cells, with an emphasis on the stability of perovskites (at the ambient condition) and development of lead- free variants for sustainable development. Followed by an overview on the key questions addressed and techniques employed, the method for synthesis of a stable all-inorganic perovskite and its charge transfer dynamics (from perovskite to charge conducting layers) is discussed and followed by the studies on lead-free perovskites. First, the role of monovalent cation on hot-carrier relaxation dynamics in a bismuth-containing double perovskite is explained. Second, the structure-property relationship and the role of the solvent on the excited state dynamics in copper-containing double perovskite is explored; further, to identify the role of surface passivation by capping ligands on carrier dynamics in this material is discussed. This thesis is concluded with a discussion on the outlook of this work.
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