TRR 142
Tailored Nonlinear Photonics

TRR Guest Scientist Lecture / Seminar

Date/Time: 18.06.2020 / 14:00 Uhr
Location: Online - BigBlueButton

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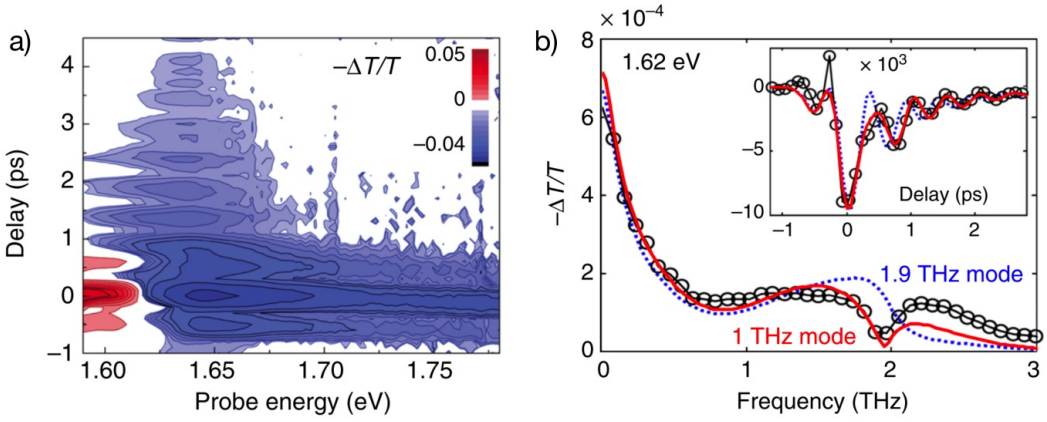
Ultrafast resonant and non-resonant manipulations of optical properties in hybrid perovskites

Abstract:

Hybrid organic-inorganic lead halide perovskites are not only among outstanding low-cost photovoltaic materials, but also with intriguing behaviors coming from the soft nature of their electronic structures. As an example, I present a resonant manipulation of the near gap optical transitions via a single optical phonon mode excitation in methylammonium lead iodide perovskite (MAPbI3). We have identified the particular phonon mode which shows the strong electron-phonon coupling and renormalizes the band gap by higher populations[1]. The phonon mode assigned to be Pb-I octahedral rotations is also suggested to be responsible for the positive temperature dependence of the band gap. In this talk, I also introduce our recently developed two-dimensional spectroscopy where the mode-resolved phonon-electron couplings manifest themselves as cross peaks[2]. By gearing the frequency of intense THz pulses to be nonresonant with any phonons and interband transitions, we observe the instantaneously modulated optical transitions in the presence of external dynamic electric fields. Furthermore, we demonstrate the theoretically predicted Wannier-Stark localization in this material, with the threshold field strength lower than that of bulk GaAs[3].



References:

[1] H. Kim, J. Hunger, E. Cánovas, M. Karakus, Z. Mics, M. Grechko, D. Turchinovich, S.H. Parekh, and M. Bonn, Nat. Commun. **8**, 687 (2017).

[2] S. Qu, S. Jäger, L. Vietze, M. Grechko, M. Bonn, and H. Kim, In preparation.

[3] C. Schmidt, J. Bühler, A.C. Heinrich, J. Allerbeck, R. Podzimski, D. Berghoff, T. Meier, W.G. Schmidt, C. Reichl, W. Wegscheider, D. Brida, and A. Leitenstorfer, Nat. Commun. **9**, (2018).

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