TRR 142
Tailored Nonlinear Photonics

TRR Guest Scientist Lecture / Seminar

Date/Time: 29.04.2021 / 15:00 Uhr
Location: Online - Zoom

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A polaron hopping approach to lithium niobate charge transport

Abstract:

Nowadays, it is accepted that the light-induced charge transport in polar-oxide materials is based on a hopping model rather than on the band model, as it is for semiconductor and metals. Indeed, first studies on these materials highlighted the necessity to introduce new concepts and a new transport theory, without which it would not be possible to explain convincingly the photoelectrical properties. One of these key concepts is the one of polaron. This can be thought as a quasi-particle composed by an auto-localized charge and the relative lattice distortion that moves as a whole by hopping, giving rise to unexpected properties.
The key material where to conduct these studies is lithium niobate ($LiNbO_3$) for its large use in acousto-optical, electro-optical, ultra-fast, non-linear optical devices and holographic memories. In this framework, a deep understanding on the charge transport and the creation of a predictive model is a fundamental base to tailor the final device specification.
The preferential technique to investigate the polaron movement is the time-resolved light induced absorption spectroscopy in which the lithium niobate is exposed to a short pulse with a duration much smaller than the polaron formation and the subsequent movement in then studied in via time resolved absorption. In the talk, an approach based on a Monte-Carlo simulation is presented as method to interpret the results and to overcome some of the problems on the usual phenomenological approach. The simulation can then be used to establish a priori the material behavior when changing temperature and composition.

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