PADERBORN UNIVERSITY

Collaborative Research Center TRR 142

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PhoQS INSTITUTE FOR PHOTONIC QUANTUM SYSTEMS

CeOPP Center for Optoelectronics and Photonics Paderborn

PHOTONICS LECTURE

TUESDAY, 24 SEPTEMBER 2024 | 16H S.T.

PROF. DR. MIRCO IMLAU

LECTURE HALL A1

Polarons in motion: an excursion into defect-rich environments

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While the experimental study of polaron motion in nearly ideal lattice structures has been extensively studied and successfully compared with established theoretical concepts in the last decades, the question of the influence of pronounced defect structures on the transport of small polarons remains largely unexplored. So far, little is known about the possibilities to control polaron motion by external parameters such as superposition of artificial point defects, defect gradients, interfaces or domain structures. One of the reasons is the complexity of the required spatiotemporal studies, but also the (limited) experimental access and quality of the achievable signals.

Using the example of lithium niobate tantalate solid solutions ($LiNb_{1-x}Ta_x$, LNT), we show the results of our first experimental excursion on small polaron motion in defect rich environments by means of time-resolved, nonlinear optical spectroscopy. Based on the observation of light-induced index changes in nominally undoped single crystals we outline a possible interpretation of the particularly long-lived polaron absorption signals on the basis of three intrinsic defect centers. The small-polaron based interpretation of the bulk photovoltaic effect is used to discuss the possibilities to control and/or enhance the photovoltaic currents by point defect structures.