

“Ultrafast nanoscopy of collective excitations and interlayer charge transfer in van der Waals crystals”

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Dr. Fabian Mooshammer

Abstract

Near-field microscopy has emerged as a powerful tool for investigating the exceptional properties of van der Waals crystals on the nanoscale with femtosecond temporal resolution. In this talk, we first review the capabilities of this approach by studying photo-activated polaritons in black phosphorus heterostructures. Then, we develop a non-invasive access to the ultrafast formation and decay dynamics of interlayer excitons in transition metal dichalcogenide bilayers. By interrogating the local polarizability of electron–hole pairs with evanescent terahertz fields, we reveal pronounced variations of the exciton dynamics on deeply subwavelength length scales. Our approach should reveal how ultrafast charge carrier dynamics shape functionalities in a variety of solid-state systems.