

# Characterizing interactions between excitons in monolayer semiconductors

Andrea Bergschneider  
University of Bonn

e-mail: [abergsch@uni-bonn.de](mailto:abergsch@uni-bonn.de)

## ABSTRACT

Strongly bound excitons in transition metal dichalcogenides offer an interesting platform for investigating many-body interactions. Excitons with ground state as well as excited state wavefunctions can be created with resonant light and the different valley degrees of freedom can be addressed by different polarization of light and the intra and interspecies exciton-exciton interaction vary in strength and sign.

Recently, we utilized the optical Stark effect in semiconductors to measure exciton-exciton interactions with pump-probe spectroscopy in MoSe<sub>2</sub> as well as in WSe<sub>2</sub> [1]. With a red-detuned pump pulse we generate a virtual population of excitons and extract the coherent interaction with the excitons resonantly excited by the probe pulse from the measured resonance shift. With copolarized pulses, we observe repulsive interaction between 1s excitons and between 2s and 1s excitons. In addition, we were able to observe the existence of the 2s-1s biexciton bound state for cross-polarized pulses.

[1] M. Wegerhoff, M. Scharfstädt, S. Linden and A. Bergschneider, „Coherent interaction of 2s and 1s exciton states in Transition-Metal Dichalcogenide Monolayers“, Phys. Rev. Lett. 134, 236901 (2025).