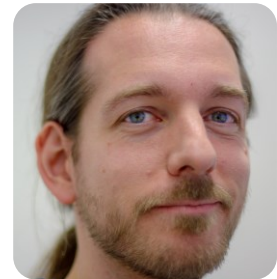




SFB – Colloquium

Speaker: **Dr. Alexander Steinhoff**
Institute for Theoretical Physics and
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Date: Tuesday, 13.02.2024, 16:00, H34

Topic: Exciton-exciton interactions in van der Waals
heterobilayers

Abstract:

Exciton-exciton interactions are key to understanding non-linear optical and transport phenomena in van der Waals heterobilayers, which emerged as versatile platforms to study correlated electronic states. In this talk, I will present a combined theory-experiment study of excitonic many-body effects based on first-principle band structures and Coulomb interaction matrix elements. Key to our approach is the explicit treatment of the fermionic substructure of excitons and dynamical screening effects for density-induced energy renormalization and dissipation. We demonstrate that dipolar blue shifts are almost perfectly compensated by many-body effects, mainly by screening-induced self-energy corrections. Moreover, we identify a crossover between attractive and repulsive behavior at elevated exciton densities. Theoretical findings are supported by experimental studies of spectrally-narrow interlayer excitons in atomically-reconstructed, hBN-encapsulated $\text{MoSe}_2/\text{WSe}_2$ heterobilayers. Our results revise the established picture of dipolar repulsion dominating exciton-exciton interactions in van der Waals heterostructures and open up opportunities for their external design.

Host: Dr. Sebastian Bange