**Title:** Interacting Excitons in van der Waals Heterostructures of TMDs

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## Abstract:

Atomically thin materials, such as graphene and transitional metal dichalcogenides (TMDs), have recently come to the forefront of research in materials physics. This is largely due to the ease with which they can be combined into artificially engineered heterostructures that exhibit emergent electronic and optical properties. Enhanced Coulomb interactions in the truly 2D limit and flat bands in TMD moiré heterostructures, such as $MoSe_2/WSe_2$, provide a rich platform to explore correlated quantum phases of matter.

In this talk, I will begin by highlighting some unique properties of optical excitations in TMDs which result from the chiral nature of constituent single-particle electronic states. Unlike their monolayer counterparts, excitons in heterobilayers feature a permanent electric dipole which can be used to tune their emission energy electrically. I will present our results showing few-body interactions between dipolar excitons which result can be exploited for quantum nonlinearity[1]. I will also present our recent results wherein many-exciton dipolar interactions result in exchange fields of ~ 6 Tesla[2]. Finally, I will conclude by discussing the outlook for realizing strongly interacting phases of optical excitations in 2D materials.

1. W. Li, X. Lu *et al., Nature Materials.* **19**, 624-629 (2020).
2. W. Li, X. Lu *et al., Nature Nanotechnology* **16**, 148-152 (2021).