



MAX PLANCK LECTURE ON NON-EQUILIBRIUM QUANTUM PHENOMENA

Spin, Charge, and Phonon Coupling Effects in 2D Materials

The coupling between spin, charge, and lattice degrees of freedom plays an important role in a wide range of fundamental phenomena. 2D material is an emerging platform for studying these coupling effects. In this talk, I will present a couple examples along this direction. I will firstly discuss the observation of antiferromagnetic exciton and multiple exciton phonon bound states in zigzag antiferromagnet NiPS_3 .

I will then present the observation of valley phonons, i.e. phonons with momentum vectors pointing to the corners of Brillouin zone, and their interaction with spins in a monolayer semiconductor WSe_2 . We identified the efficient intervalley scattering of quasi particles in both exciton formation and light emission process. These understandings enable us to unravel a series of photoluminescence peaks as valley phonon replicas of neutral and charged dark excitons.

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