Exciton Complexes and Spin/valley Pumping in 2D semiconductors

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In this talk I will first recall briefly the general properties of 2D excitons in Transition Metal Dichalcogenides (TMD) monolayers: giant binding energy, oscillator strength, exchange interactions, spin/valley...[1].

Encapsulation of TMD monolayers in hexagonal boron nitride (hBN) yields narrow optical transitions approaching the homogeneous exciton linewidth[2,3]. We demonstrate that the exciton radiative rate in these van der Waals heterostructures can be tailored by a simple change of the hBN encapsulation layer thickness as a consequence of the Purcell effect [4].

We also measured the exciton fine structure of MoS_2 and $MoSe_2$ monolayers encapsulated in boron nitride by magneto-photoluminescence spectroscopy in magnetic fields up to 30 T [5,6].

Finally, I will present recent experimental results on spin/valley pumping of resident electrons in WSe_2 and WS_2 monolayers[7,8]. The spin/valley diffusion length of these electrons will also be discussed[9].

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