Exciton dynamics in 2D TMDs heterostructures

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Abstract: Van der Waals (vdW) heterostructures based on transition metal dichalcogenides (TMDs) generally possess a type-II band alignment that facilitates the formation of interlayer excitons between constituent monolayers.[1,2] The study of interlayer excitons in TMD vdW heterostructures holds great promise for the excitonic devices, allowing the photons and excitons to transform into each other and thus bridge optical communication and signal processing. Various studies have been carried out to obtain deep insight into the physical properties of interlayer excitons, revealing their ultrafast formation, longer lifetimes, and intriguing spin-valley dynamics.[1-3] These outstanding features ensure interlayer excitons have good transport characteristics, which provide their potential lasing applications in efficient excitonic devices based on TMD vdW heterostructures.[3] A systematic and comprehensive overview of interlayer exciton formation, relaxation, transport, and possible applications still needs to be provided. In this work, we put three different TMDs to design a more controlled interlayer excitons system that overcomes the tunnelling barrier in TMD vdW to reduce negligible Coulomb interaction overlap of the electron & hole wavefunctions. The details will be presented.

References

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Figures

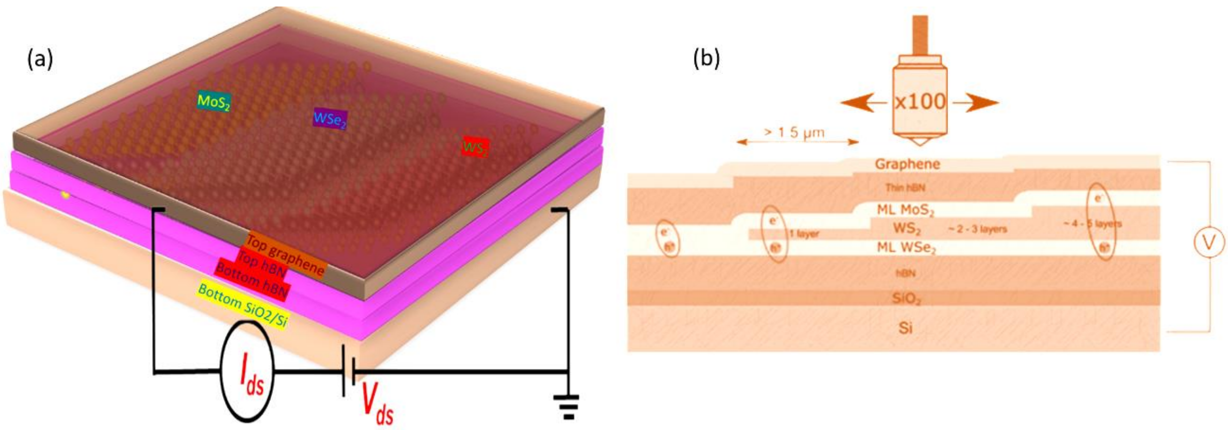

Figure 1: Schematic representation of tuning of interlayer excitons in TMDs heterostructure (a) $MoS_2/WSe_2/WS_2$ heterostructures in a field-effect device (b) Overview of sample structure to be measured in the optical setup.