Valley Excitons in van der Waals Heterostructures

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Two-dimensional materials have recently developed into a powerful platform from which to explore the science of surfaces and interfaces. Of particular excitement is their use as versatile building blocks for more advanced van der Waals heterostructures. Here we present our latest experimental progress in understanding the interfacial effects on excitons in two types of van der Waals heterostructures. We first discuss the interlayer excitons formed at the interface between two different monolayer semiconductors, $MoSe_2$ and WSe_2. Through photoluminescence measurements, we reveal that these excitons possess valley pseudospin properties like their intralayer counterparts, but with enhanced lifetime and intriguing relaxation dynamics. We then introduce a new van der Waals heterostructure between monolayer WSe_2 and an ultrathin ferromagnetic semiconductor, CrI_3. Strong interfacial magnetic interactions have a dramatic effect on the WSe_2 exciton valley properties. We also demonstrate that basic optical studies on this type of heterostructure can provide rich information on the spin interactions in layered magnets.

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