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Valleytronics with interlayer excitons in $MoSe_2$-WSe_2 heterostructures

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Monolayer transition metal dichalcogenides ($MoSe_2$, WSe_2) are direct bandgap semiconductors. The optical properties of these two-dimensional (2D) semiconductors are dominated by excitons that occur at two nonequivalent (K and –K) valleys on the edge of the Brillouin zone. In this presentation, I will discuss the electronic and optical physics of 2D heterostructures that are fabricated by vertically stacking single monolayers of WSe_2 and $MoSe_2$ together. The resulting 2D heterostructure realizes a type-II junction, allowing for the formation of interlayer excitons with the electron in the $MoSe_2$ layer and the hole in the WSe_2 layer. I will show that the valley physics of the monolayers is inherited by the interlayer excitons, evidenced by helicity dependent photoluminescence measurements, and report on the dynamics of interlayer exciton relaxation. I will discuss applications of interlayer excitons to valleytronics, which in analogy to spin in spintronic, seeks to utilize valley polarizations for low power information processing.