24

Momentum-resolved valleytronic dynamics in atomically thin semiconductors

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Abstract

In two-dimensional transition metal dichalcogenides (TMDCs), strong spin-orbit coupling and Coulomb interactions result in a variety of bright and dark excitonic states with additional valley degree of freedom. Time-resolved momentum microscopy allows for investigating the momentum-resolved electron dynamics within the whole Brillouin zone. The further extraction of spin- and valley-information is provided by the preparation of a well-defined initial excited state with a single spin- and valley-polarization. For this reason, we use a customized optical pumping scheme which enables excitation under near-normal incidence with circular polarized light while maintaining a time resolution of 10 fs.

We traced the electron dynamics at room temperature in both WS_2 and $MoSe_2$ from a single spin-polarized state at the K-valley and disentagled underlying scattering rates to K', Σ and Σ'.