All optical information processing has long been a major research field for scientists and engineers, as this might be a feasible way of ultrafast and energy efficient computing. However, finding the nonlinear optical materials mediating the required strong photon-photon interactions has been a challenge. With their enhanced light matter interaction, atomically thin transition metal dichalcogenides (TMDs) such as MoS2 and WSe2 appeared as strong candidates for such applications. Monolayer TMDs not only possess an optically accessible band structure, known as valleys, but can also be stacked with other monolayer flakes to tune their optical response. In this talk, I will describe our efforts to understand how two ultrashort light pulses interact on an atomically thin semiconductor. Using novel pump-probe microscopy and sample preparation techniques, we were able to extract the dynamical parameters such as excited state and valley polarization lifetimes of hBN/WSe2/hBN heterostructures. Furthermore, the high quality samples allowed us to observe the formation of a valley selective quantum coherent state and the associated valley coherence lifetime. Finally, we investigated the implications of many-body interactions between optically bright and dark excitations on the non-equilibrium band structure. These experiments helped us understand the ultrafast dynamics in monolayer TMDs and will be a guide for future exploration of other emerging 2D materials such as 2D heterostructures with a twist angle.