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Exciton and Trion Valley dynamics in WSe2 measured by two-color pump-probe[1] AKSHAY SINGH, KHA TRAN, JOE SEIFERT, YIPING WANG, Univ of Texas, Austin, MARIE SCOTT, university of washington, seattle, DENNIS PLESKOT, NATHANIEL GABOR, University of California, Riverside, JIAQIANG YAN, DAVID MANDRUS, University of Tennessee, Knoxville, XIAODONG XU, university of washington, seattle, XIAOQIN LI, Univ of Texas, Austin — Monolayer transition metal dichalcogenides are semiconducting materials demonstrating spin-valley coupling as well as quasiparticles with large binding energies. These quasiparticles, excitons and trions (charged excitons), have quite different spin polarization properties, with the trion having larger spin lifetimes than excitons. Photoluminescence and time resolved Kerr rotation techniques have been used earlier to measure spin lifetimes. However, most of these early optical measurements have relied on non-resonant excitation conditions which tend to mask the intrinsic valley (spin) scattering properties. Here, we use circularly polarized two-color pump probe spectroscopy to measure valley (spin) polarization in monolayer WSe_2 at low temperatures. We utilize quasi-resonant excitation with pump 1 meV (0.5 nm) spectrally separated from the probe, thus resulting in very efficient valley initialization. We present polarization resolved measurements on resonantly excited excitons and trions, which suggest that trions have larger spin lifetimes. Further, we probe spin polarization of trions when pumping at exciton energies, and vice-versa. We discuss the relative importance of different scattering mechanism at play.

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