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Nanosecond Valley Polarization in Suspended Monolayer Tungsten Sulfide ANDY BARRETTE, CHAO XU, YIFEI YU, YILING YU, LINYOU CAO, KENAN GUNDOGDU, North Carolina State Univ, GUNDOGDU GROUP TEAM, NANOSCALE PHOTOPHYSICS AND PHOTOCHEMISTRY GROUP TEAM — Monolayer transition metal dichalcogenides (TMD) have a vast range of interesting electronic and optical characteristics due to symmetry properties and selection rules. For carriers, these properties result in coupled spin and valley degrees of freedom and coupling between valley polarization circular polarization of excitation source. Because of these unique properties, TMDs are thought to have potential valleytronic applications, however to the detriment of these potential applications, recent optical studies have shown that carriers undergo valley relaxation very quickly, within tens of picoseconds. Using circularly polarized ultrafast transient absorption spectroscopy, we find that valley relaxation in suspended tungsten sulfide (WS_2) decays on the order of a nanosecond - two orders of magnitude slower than in supported samples. We discuss our results in the context of recent theoretical work which suggests that the predominant valley relaxation mechanism in monolayer TMDs is the electron-hole exchange interaction. Finally, we use valley relaxation measurements at several temperatures to conclude that the remaining nanosecond valley relaxation results from the flexural phonon mechanism.

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