

Abstract Submitted  
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**Long-Lived Valley Polarization of Intra-Valley Trions in Monolayer WSe<sub>2</sub>**<sup>1</sup> KHA TRAN, AKSHAY SINGH, Univ of Texas, Austin, MIRCO KOLARCZIK, Technische Universitat Berlin, JOE SEIFERT, YIPING WANG, KAI HAO, Univ of Texas, Austin, DENNIS PLESKOT, NATHANIEL GABOR, University of California, Riverside, SOPHIA HELMRICH, NINA OWSCHIMIKOW, ULRIKE WOGGON, Technische Universitat Berlin, XIAOQIN LI, Univ of Texas, Austin — We report distinct valley dynamics associated with intervalley and intravalley trions in monolayer WSe<sub>2</sub>. Using circular two-color pump-probe spectroscopy, we observe no decay of a near-unity valley polarization associated with the intra-valley trions during  $\sim 25$  ps, while the valley polarization of the inter-valley trions exhibits a fast decay of  $\sim 4$  ps. Moreover, we show that intrinsic dynamics associated with the two types of trions can only be observed when they are excited resonantly. The exceptionally robust valley polarization associated with resonantly created intravalley trions in monolayer WSe<sub>2</sub> may be exploited for applications of valleytronic applications such as the valley Hall effect.

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