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Valley Carrier Dynamics in Monolayer Molybdenum Disulphide from Helicity Resolved Ultrafast Pump-probe Spectroscopy DONG SUN, QINSHENG WANG, SHAOFENG GE, XIAO LI, JUN QIU, YANXIN JI, JI FENG, Peking University, INTERNATIONAL CENTER FOR QUANTUM MATERIALS TEAM — We investigate the valley related carrier dynamics in monolayer MoS₂ using helicity resolved non-degenerate ultrafast pump-probe spectroscopy at the vicinity of the high-symmetry K point under the temperature down to 78 K. Monolayer MoS₂ shows remarkable helicity resolved transient reflection signals, in stark contrast to bilayer and bulk MoS₂ due to the enhancement of many body effect at reduced dimensionality. The ultrafast time-resolved result shows that the valley polarization is preserved for only around 1 ps before scattering process makes it undistinguishable. We suggest that the dynamical degradation of valley polarization is attributable primarily to the exciton trapping by defect states in the exfoliated MoS₂ samples. Our experiment and a tight-binding model analysis also show that the perfect valley CD selectivity is fairly robust against disorder at the K point, but quickly decays from the high-symmetry point in the momentum space in the presence of disorder.

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