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Coupled spin-valley-dynamics in singe-layer transition metal dichalcogenides GERD PLECHINGER, PHILIPP NAGLER, CHRISTIAN SCHÜLLER, TOBIAS KORN, Institut für Experimentelle und Angewandte Physik, Universität Regensburg, D-93040 Regensburg, Germany — Single layers of transition metal dichalcogenides (TMDCs) like MoS_2 and WS_2 can be produced by simple mechanical exfoliation. Offering a direct bandgap at the K-points in the Brillouin zone, they represent a promising semiconductor material for flexible and transparent optoelectronic applications. Due to inversion symmetry breaking together with strong spin-orbit-interaction, the valley and spin degrees of freedom are coupled in monolayer TMDCs. Via circularly polarized optical excitation, an efficient polarization of the K^+ or the K^- valley can be generated. Here, we investigate the dynamics of these coupled spin-valley polarizations in monolayer MoS_2 and WS_2 by means of photoluminescence spectroscopy and time-resolved Kerr rotation (TRKR). The results indicate a maximum achievable spin-valley-lifetime in these materials exceeding one nanosecond at low temperatures. Furthermore, we extract the dependence of the spin-valley lifetime on temperature. By varying the excitation energy, we reveal the excitonic resonances as well as the spin-polarized bandstructure around the K valleys common to monolayer TMDCs.

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