Abstract Submitted
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Optical polarization and intervalley scattering in single layers of MoS_2 and $MoSe_2$[1] BEREND JONKER, Naval Research Laboratory, GEORGE KIOSEOGLOU, University of Crete, AUBREY HANBICKI, MARC CURRIE, ADAM FRIEDMAN, Naval Research Laboratory, NRL / U. CRETE COLLABORATION, NRL / U. CRETE COLLABORATION — We probe the valley population dynamics in $MoSe_2$ and MoS_2 by selectively populating the K and K' valleys with circularly polarized light while systematically varying the laser excitation energy. For both systems, the difference in the excitation energy and photoluminescence emission energy, $dE = E_{pump} - E_{PL}$, governs the depopulation of carriers in each valley. Adding more energy above a distinct threshold characteristic of the longitudinal acoustic (LA) phonon for each material enables inter-valley scattering and produces a sharp decrease in the observed circular polarization. LA phonons in these two systems have different energies (30 meV for MoS_2 and 19 meV for $MoSe_2$), and we show that the threshold for the excess energy required to initiate the depolarization process clearly reflects the material specific phonon energy. In addition, our results show that independent of how many carriers are excited, i.e. whether you create neutral or charged excitons, the scattering process is the same. We find that the key parameter for the depolarization process is the extra kinetic energy of the exciton – depolarization is due to intervalley scattering that begins to occur when the exciton energy exceeds a threshold corresponding to twice the LA phonon energy.

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