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Group theory analysis of the intrinsic momentum and spin relaxation in monolayer dichalcogenides[1] YANG SONG, Department of Physics and Astronomy, University of Rochester, Rochester, New York, 14627, HANAN DERY, Department of Electrical and Computer Engineering, Department of Physics and Astronomy, University of Rochester, Rochester, New York, 14627 — Using group theory, we study the intrinsic momentum and spin relaxation of electrons and holes due to scattering with phonons in monolayer dichalcogenides. Double group symmetry representations of electron and hole states at high symmetry points (K, K', and Γ points as well as the T axis) are identified with the help of results from absorption and photoluminescence experiments. We link the leading contributions to intravalley and intervalley scattering with symmetries of the nine phonon dispersion branches. Scattering matrix elements due to short-range interaction and the corresponding Elliott-Yafet spin-flip mechanism are expressed analytically, leading to explicit wavevector-dependence and scattering integrals. Long-range interaction are similarly analyzed. Due to the absence of inversion symmetry, valley-spin coupling is revealed to be a general feature in the spin-flip scattering. Using these results we estimate the temperature-dependent relaxation times. Intervalley scattering between valleys not connected by time-reversal is shown to be compound dependent. The K to T transition (K to Γ transition) in the conduction (valence) band is relevant in heavier (lighter) compounds such as WSe_2 (MoS_2).

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