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Polarity Change of Nonlinear Absorption between Monolayer and Bilayer/Multilayer TIKARAM NEUPANE, QUINTON RICE, DULITHA JAYAKODIGE, BAGHER TABIBI, FELIX SEO, Hampton University — The monolayer of TMDC has a direct bandgap which is wider than the indirect bandgap of the bilayer/multilayer. The bandgap can be modified based on the number of layers and the temperature. The change of bandgap plays an important role in the nonlinear absorption process which can be illustrated through the Jablonski diagrams. Two-step absorption with one photon for each step, two-photon absorption to the real final state through a virtual intermediate state, and two-photon excitation to the virtual final state through a virtual intermediate state are all included in the nonlinear absorption process. The allowed electric dipole transition $| \, i \, \rangle \rightarrow | \, f \, \rangle$between the two states in the one-photon excitation is due to different parities. Saturable (negative) absorption (SA) occurs when the ground-state absorption cross-section is higher than the excited-state absorption cross-section, $\sigma_g > \sigma_e$. Alternatively, the allowed electric dipole transitions $| \, i \, \rangle \rightarrow | \, m \, \rangle$and $| \, m \, \rangle \rightarrow | \, f \, \rangle$between the initial and final states in the two-photon excitation are due to the same parities. The reverse saturable (positive) absorption (RSA) becomes dominant when the excited state absorption cross-section is higher than the ground-state absorption cross-section, $\sigma_e > \sigma_g$. Atomic layers that show SA are utilized for laser Q-switching and mode-locking, while the atomic layers which demonstrate RSA are utilized for optical power limiting. Acknowledgements: This work at HU is supported by NSF HRD-1137747, ARO W911NF-15-1-0535, and NASA NNX15AQ03A.

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