Effects Of Intraband Transitions On The Spectrum Of Excitons In Two-Dimensional Semiconductors

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Transition metal dichalcogenide (TMD) monolayers remain the most interesting two-dimensional materials for optoelectronic applications due to their unique valley-dependent electronic properties. In particular, the superposition of intravalley exciton states in non-equivalent ±K points can be considered as a qubit, which can be used for various quantum technologies. The possibility of manipulation of such qubits for dark intravalley excitons with the help of intensive magnetic fields has been demonstrated in 2019 [1]. Then, a similar control for bright excitonic states by non-resonant circularly polarized light has been manifested experimentally and explained theoretically [2,3]. The theoretical analysis was based on the Semiconductor Bloch equations (SBE) where the dominant interband transition terms have been considered. This approximation is valid for small intensities of applied optical pulses only, and it should be reconsidered for the case of more intensive pulses. We analyze the solutions of the SBE where the previously neglected intraband term, responsible for the electron dynamics within the separate bands, is taken into account. We develop the new perturbation technique and calculate the corrections to the shifts of intravalley excitons' energies in TMD monolayers. The possibility of the experimental measurement of the obtained results is discussed.

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