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Storing excitons in transition-metal dichalcogenides using dark states[1] DANIEL GUNLYCKE, Naval Research Laboratory, FRANK TSENG, NRL/NRC Research Associate, ERGUN SIMSEK, The George Washington University — Monolayer transition-metal dichalcogenides exhibit strongly bound excitons confined to two dimensions. One challenge in exploiting these excitons is that they have a finite life time and collapse through electron-hole recombination. We propose that the exciton life time could be extended by transitioning the exciton population into dark states. The symmetry of these dark states require the electron and hole to be spatially separated, which not only causes these states to be optically inactive but also inhibits electron-hole recombination. Based on an atomistic model we call the Triangular Lattice Exciton (3ALE) model, we derive transition matrix elements and approximate selection rules showing that excitons could be transitioned into and out of dark states using a pulsed infrared laser. For illustration, we also present exciton population scenarios based on different recombination decay constants. Longer exciton lifetimes could make these materials candidates for applications in energy management and quantum information processing.

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