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Excitonic potential engineering and trion confinement in two-dimensional transition metal dichalcogenides KRISTIAAN DE GREVE, LUIS JAUREGUI, KE WANG, ANDREY SUSHKO, ALEXANDER HIGH, YOU ZHOU, GIOVANNI SCURI, DOMINIK WILD, PHILIP KIM, Harvard University, department of Physics, HONGKUN PARK, Harvard University, department of Chemistry, MIKHAIL LUKIN, Harvard University, department of Physics — Optically active, two-dimensional van der Waals materials, such as the transition metal dichalcogenides (TMDCs), have recently emerged as an interesting platform for novel optoelectronic devices and device physics. Many of the attractive properties of the TMDCs can be attributed to a combination of their large excitonic binding energy, the ability to stack multiple layers into a van der Waals heterostructure, and the large spin-orbit coupling that gives rise to spin-valley locking. The two-dimensional nature and large excitonic binding energy allow for interesting ways to explore novel quantum optical effects in TMDCs. In this work, we demonstrate recent results in manipulating excitons and trions (charged excitons). By controlling the dielectric environment of the TMDCs, excitonic potential landscapes can be created that could be exploited in future, quantum coherent excitonic devices. Similarly, by exploiting the large excitonic binding energy, trions can be manipulated and confined electrostatically to create hybrid, electrically and optically active quantum dots.

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