Phonon-driven spin dynamics in the valleys of TMDC

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Non-conventional device functionalities of two-dimensional materials, based on their extraordinary quantum mechanical properties, have fascinated many researchers in various fields. Among them, the exfoliated few-layer transition metal dichalcogenides have recently attracted focused attention owing to their valley degree of freedom. Here, using time-dependent density functional theory, we investigated the phonon-driven dynamics of a spin state at the valleys of monolayer MoS_2. We show that the spin motion is strongly coupled to an optical phonon which breaks lattice mirror symmetry. We analyzed the Floquet spectrum of this phonon-dressed spinors whose time-periodicity is defined by the phonon period. When the phonon is pumped with a circular polarity so as to break the system's time-reversal symmetry, the dichroic responses of the phonon-coupled spins on both valleys lead to a net non-zero magnetic moment. We see that this emerging magnetism, as a result of the coupling of the valley spinors and the phonon, can be exploited as a novel spin manipulation method.