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Generation and Detection of Coherent THz Acoustic Phonons in Few Atomic Layer MoS2 HAINING WANG, CHANGJIAN ZHANG, WEI MIN CHAN, SANDIP TIWARI, RANA FARHAN, Cornell University — We present, for the first time, results on the generation and detection of coherent THz acoustic phonon oscillations in few-monolayer MoS2 by ultrafast pump-probe technique. In $\sim$ 1nm thick Dichalcogenides, the lowest confined LA phonon modes in the out-of-plane direction can have frequencies approaching one THz. In our experiments, a pump pulse is used to excite these phonon modes through the Raman process. The refractive index of few-layer MoS2 is sensitive to the layer separation, and, therefore, the transmission of the probe pulse changes with the layer separation allowing us to observe coherent phonon oscillations in real time. The measured phonon frequencies, for different number of monolayers (from $\sim$3 to $\sim$100), agree well with analytical model based on the quantization of the bulk LA phonon dispersion in the out-of-plane direction and the interlayer force constant was extracted. Our data also allow us to extract phonon lifetimes and quality factors. The observed ultrafast dynamics of the photoexcited carriers also evolve with the number of monolayers as the electronic bandstructure evolves.

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