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Probing the Band Structure of Ultrathin $MoTe_2$ via Strain BURAK ASLAN, ISHA DATYE, HSUEH-HUI KUO, MICHAL MLECZKO, IAN FISHER, ERIC POP, Stanford Univ, TONY HEINZ, Stanford Univ and SLAC —
Molybdenum ditelluride ($MoTe_2$) is a semiconducting layered group VI transition metal dichalcogenide with an optical band gap of 1.1 and 0.9 eV in the monolayer and bulk, respectively. The bulk crystal possesses an indirect gap whereas the monolayer has a direct one. It is still under debate whether the direct-to-indirect gap crossover occurs at the monolayer or bilayer limit at room temperature, resulting from the fact that the two gaps are very close to one another in ultrathin crystals. We take advantage of this closeness by tuning the two gaps with in-plane tensile strain. In particular, we employ photoluminescence and absorption spectroscopy to probe the near-band-edge optical transitions and study their line-shapes to distinguish the direct and indirect gaps in few-layer $MoTe_2$. We observe that the applied strain redshifts the direct and indirect gaps at different rates and strongly affects the spectral widths of the optical transitions. Our observations help us understand what contributes to the broadening of the A exciton peak in ultrathin $MoTe_2$ and how the direct-to-indirect gap crossover occurs with decreasing thickness.

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