Highlights

Innovative materials with strong interplay of spin orbital charge and topological degrees of freedom - 2019

Anomalous and Polarization-Sensitive Photoresponse of T_d-WTe_2 from Visible to Infrared Light

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ADVANCED MATERIALS 31 (2019) 1804629

Recently, an emergent layered material T_d–WTe_2 was explored for its novel electron-hole overlapping band structure and anisotropic inplane crystal structure. Here, the photoresponse of mechanically exfoliated WTe_2 flakes is investigated. A large anomalous current decrease for visible (514.5 nm), and mid- and far-infrared (3.8 and 10.6 μm) laser irradiation is observed, which can be attributed to light-induced surface bandgap opening from first-principles calculations. The photocurrent and responsivity can be as large as 40 μA and 250 A W^{-1} for a 3.8 μ m laser at 77 K. Furthermore, the WTe_2 anomalous photocurrent matches its in-plane crystal structure and exhibits light polarization dependence, maximal for linear laser polarization along the W atom chain *a* direction and minimal for the perpendicular *b* direction, with the anisotropic ratio of 4.9. Consistently, first-principles calculations confirm the angle-dependent bandgap opening of WTe_2 under polarized light irradiation. The anomalous and polarization-sensitive photoresponses suggest that linearly polarized light can significantly tune the WTe_2 surface electronic structure, providing a potential approach

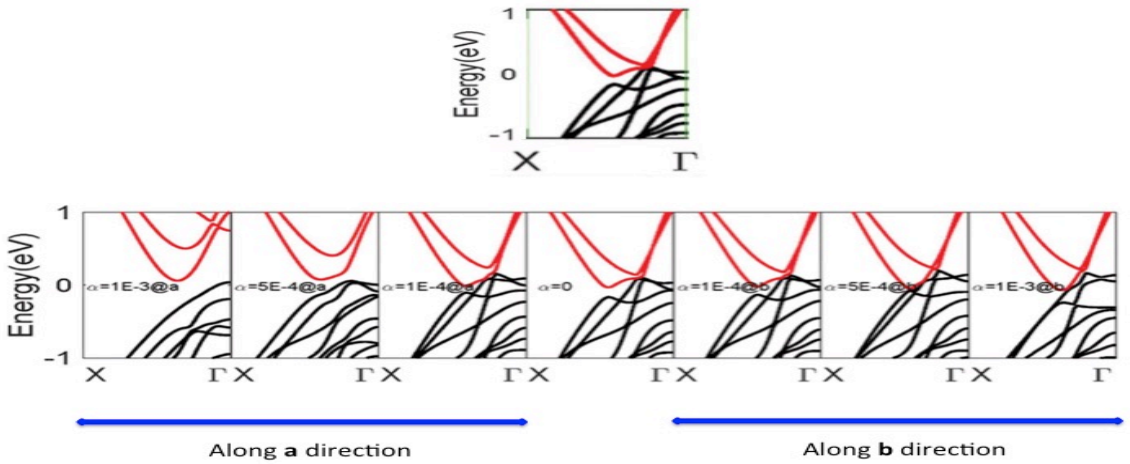

Fig. 1: The bulk WTe_2 electronic structure without laser irradiation (top panel). WTe_2 electronic structure along X–Γ directions for different values of parameter α when the 700 nm linear polarization direction of the light is along the **a** or **b** directions - α is a parameter related to the input laser power, its physical meaning is the number of excitons mixed in the electrons of a unit cell (bottom panel).