

Abstract Submitted
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Large Ultraviolet Photoresponsivity of Few-layer Black Phosphorus¹ JING WU, GAVIN KOK WAI KOON, DU XIANG, ANTONIO H. CASTRO NETO, BARBAROS OZYILMAZ, Natl Univ of Singapore, CENTRE OF ADVANCED 2D MATERIALS TEAM — Black phosphorus has recently gained much attention in the scientific community. Black phosphorus can be seen as a crystal generated by periodic repetition of tetraphosphorus (P_4) molecules. It is known that tetraphosphorus P_4 can be transformed temporarily to diphosphorus P_2 upon ultraviolet (UV) irradiation. Thus, it is expected that the P_4 structured black phosphorus also has strong interaction with light especially in the UV range. Here we report on the optoelectronic characteristics of few-layer black phosphorus field effect transistors (FETs) ranging from the UV to the near infrared (NIR). We demonstrate that black phosphorus is an excellent ultraviolet (UV) photodetector with a specific detectivity $\sim 3 \times 10^{13}$ Jones. We report also an exceptional photoresponsivity of 10^7 times higher than previously reported values for black phosphorus visible light photodetectors. We attribute such a colossal UV photoresponsivity to the resonant-interband transition between two specially nested valence and conduction bands. These nested bands provide an unusually high density of states for high-efficient UV absorption due to their singularity nature.

¹Large Ultraviolet Photoresponsivity of Few-layer Black Phosphorus

JING WU
Natl Univ of Singapore

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