Electronic supplementary information:

Strain modulation of the exciton anisotropy and carrier lifetime in black phosphorene

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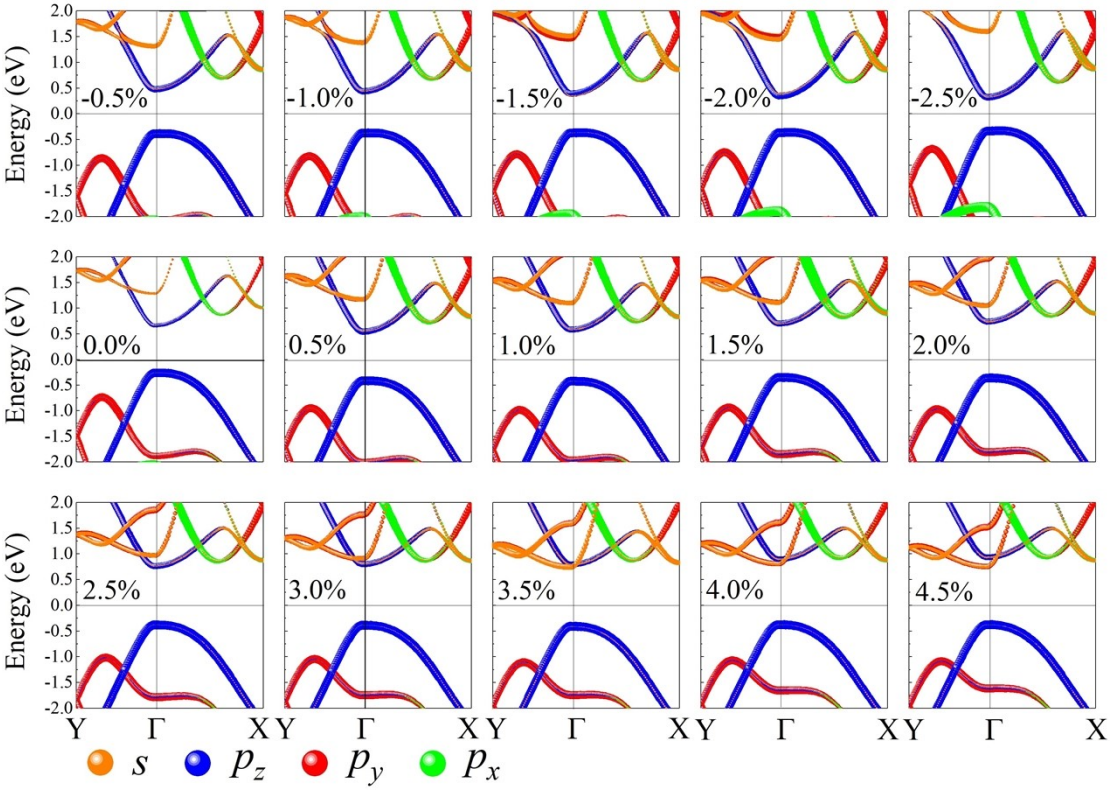

Fig. S1. The projected band structures of monolayer BP under strain. The Fermi energy level is set to 0 eV.

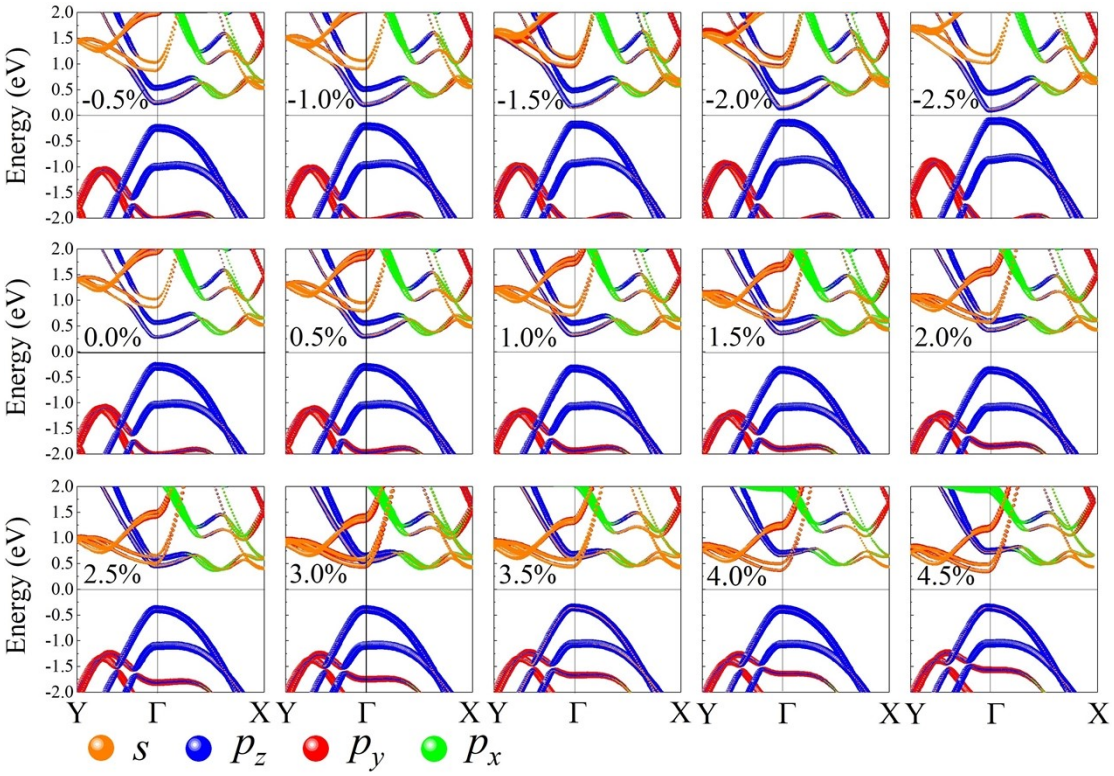

Fig. S2. The projected band structures of bilayer BP under strain. The Fermi energy level is set to 0 eV.

From Fig. S1 and Fig. S2, the band structures under -2.5%~3.0%/3.5%~4.5% (-2.5%~2.5%/3.0%~4.5%) strain exhibit similar characteristics of band edges for monolayer (bilayer) BP. The compressive strain reduces the band gap, while the main characteristics of the band edges are retained. The tensile strain results in the realignment of the conduction bands, when the tensile strain increases to 3%, the *s* and p_y orbital dominate the CBM, which can result in interesting optical properties.

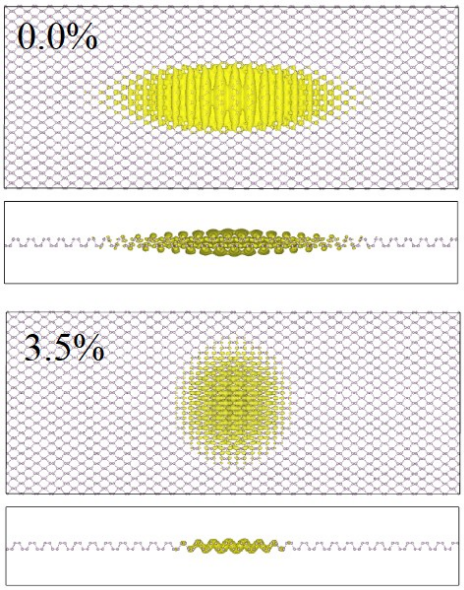

Fig. S3. The first exciton-distribution of the monolayer BP in real space.

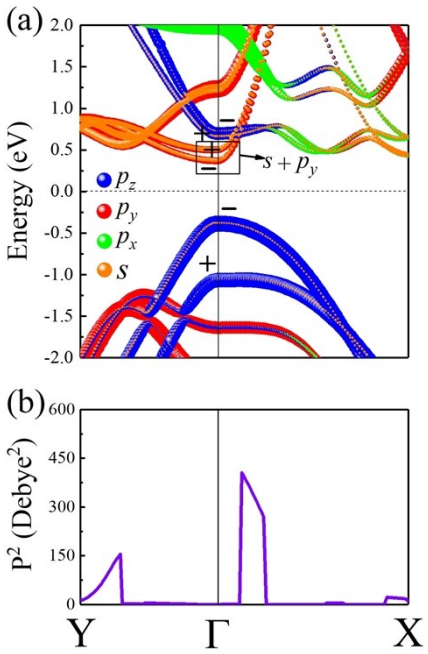

Fig. S4. The projected band structure and the STDM for the 4% strain bilayer BP. The Fermi energy level is set to 0 eV. Symbol '-' represents odd parity, symbol '+' represents even parity.

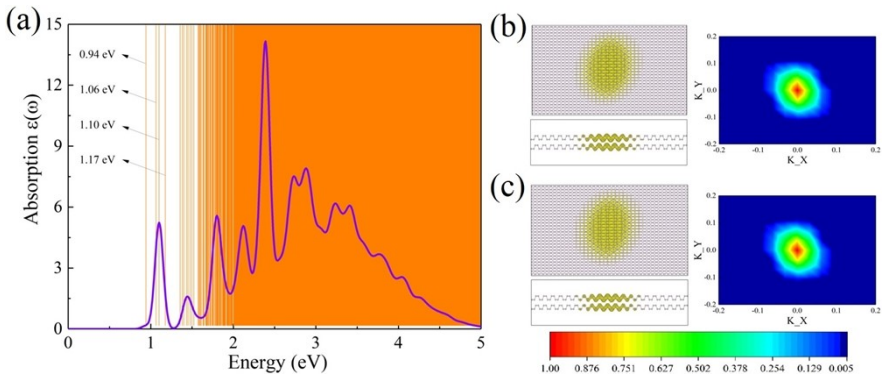

Fig. S5. The quasi-particle results of 4% stain bilayer BP: (a) dielectric function and exciton level, the exciton distribution in real and reciprocal space for (b) first exciton and (c) second exciton.