Supporting Information

Visible and Infrared Photodetector based on γ-InSe/Ge van der Waals Heterojunction For Polarized Detection and Imaging

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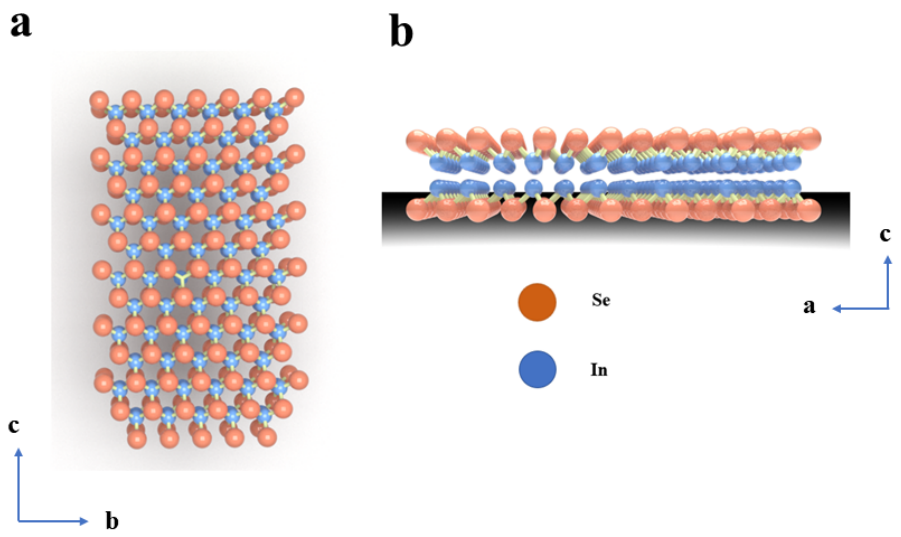

Figure S1. The lattice structure of 2D γ-InSe nanosheet. (a) the b-axis views and (b) the a-axis views of InSe atomic structure.

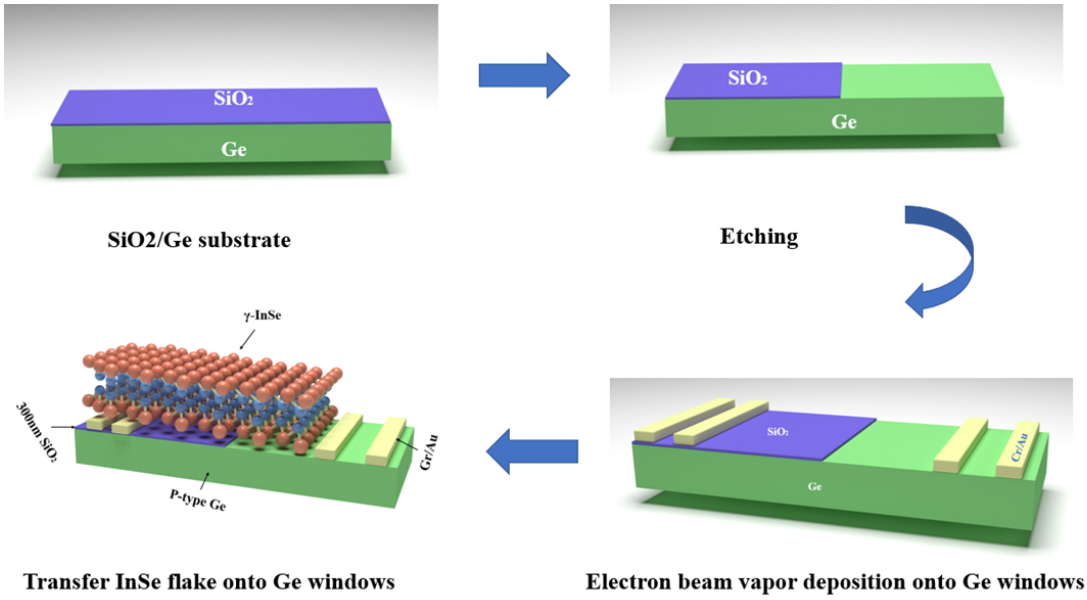

Figure S2. Schematic illustration for the fabrication process of InSe/Ge van der Waals heterojunction photodiode.

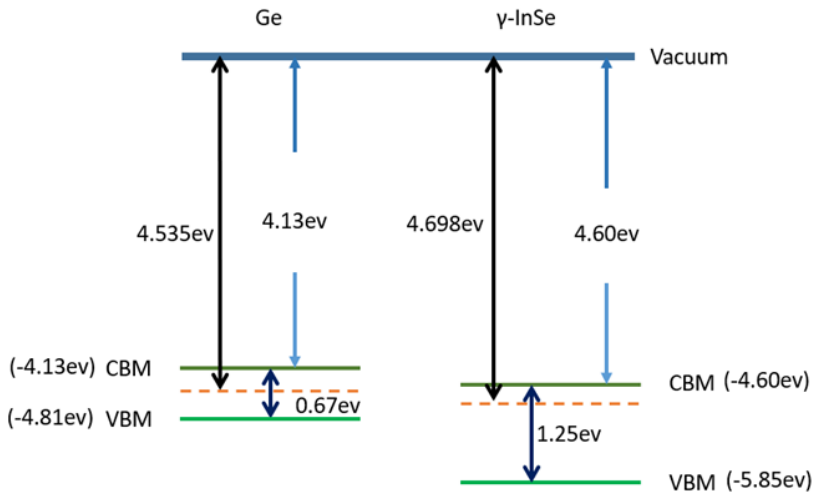

Figure S3. Band diagram of Ge and InSe before contact.

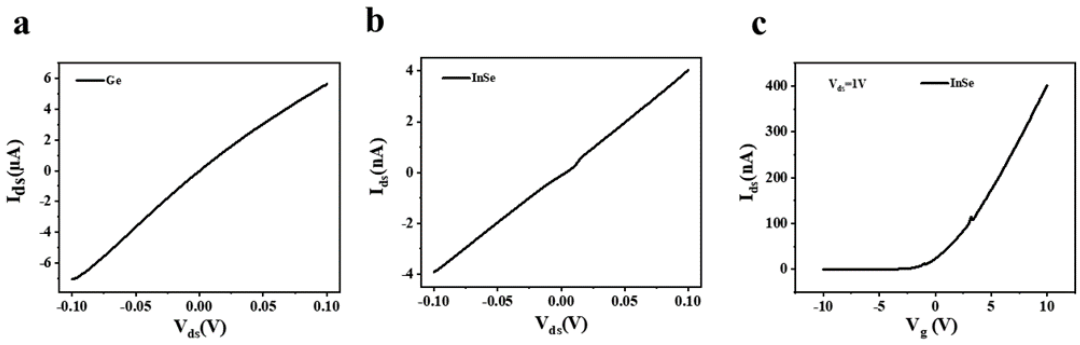

Figure S4. (a, b) I_{ds}-V_{ds} curves of individual Ge and InSe based devices, respectively. (c). Transfer curve of γ-InSe.

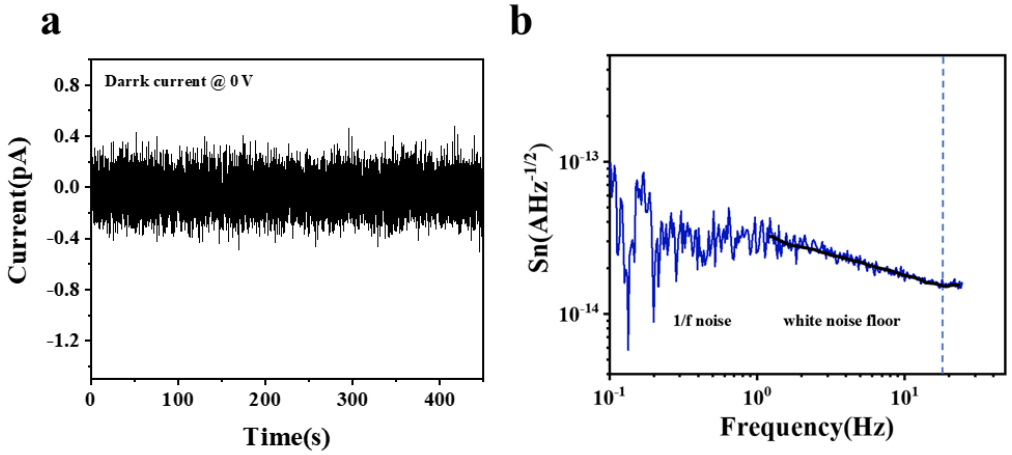

Figure S5. (a) Dark current at V_{ds} = 0 V and (b) Noise spectral density as a function of frequency at V_{ds} = 0 V

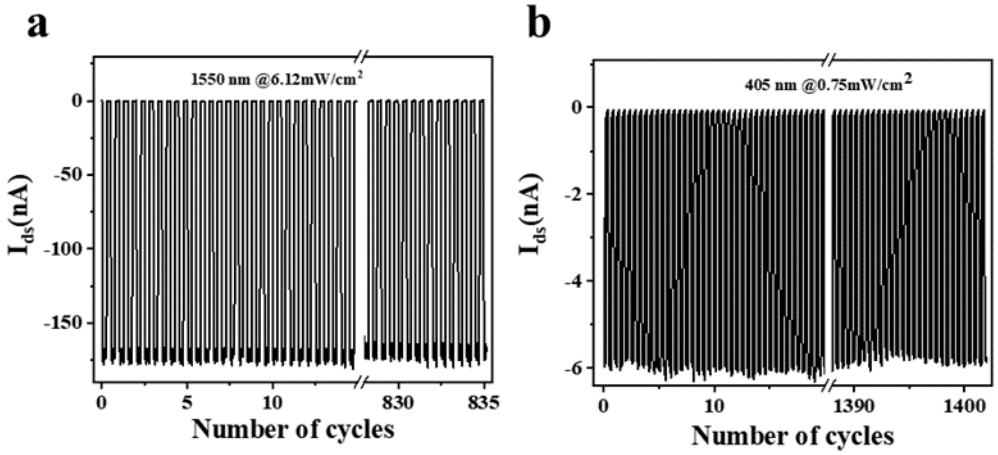

Figure S6. (a, b). The long-term photo-response curves at zero bias under 1550 and 405 nm light irradiation.

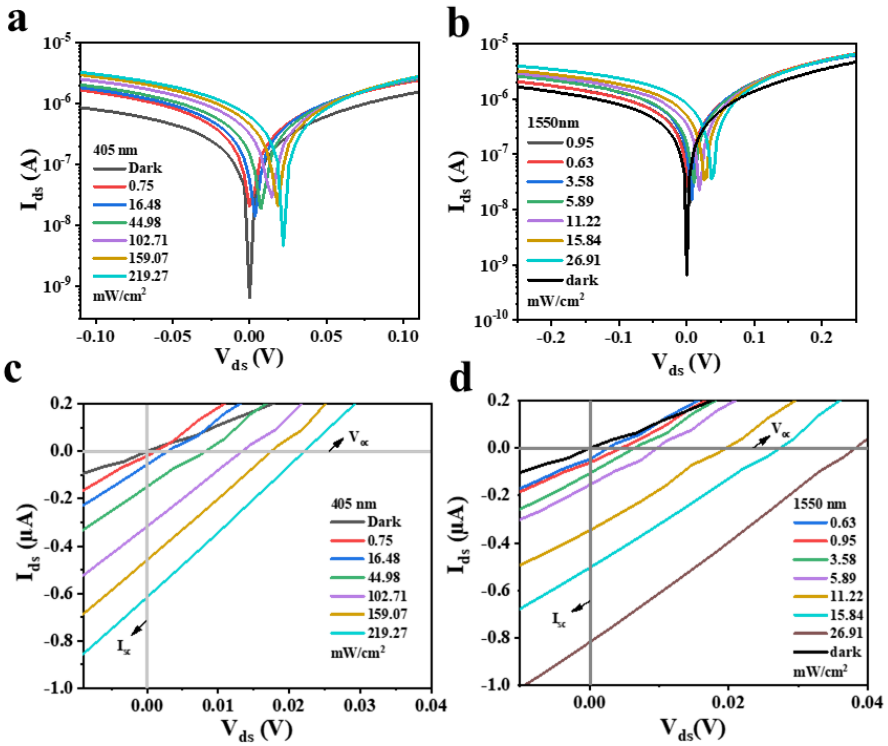

Figure S7. I_{ds}-V_{ds} of the device with the dark and various infrared light power at 1550 nm (a), 405 nm (b). (c), (d) Enlarged I_{ds}−V_{ds} curves of the heterojunction device in dark and under 405 and 1550 nm with various light power densities.

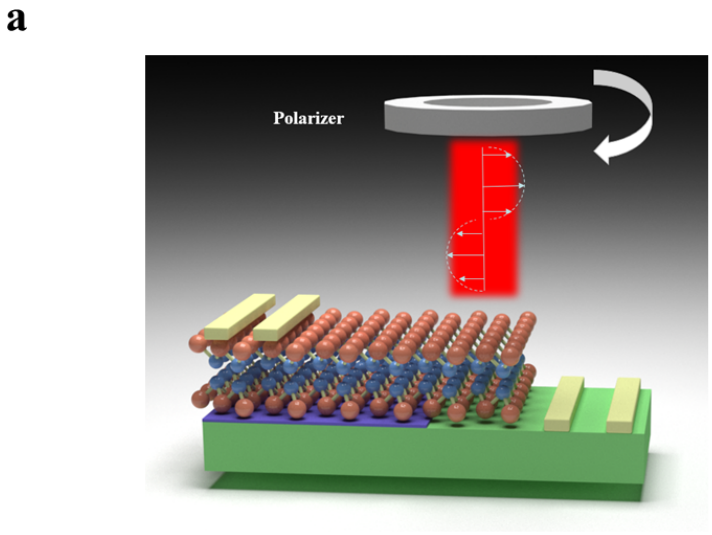

Figure S8. Schematic diagram of the test system of the polarization photodetector.

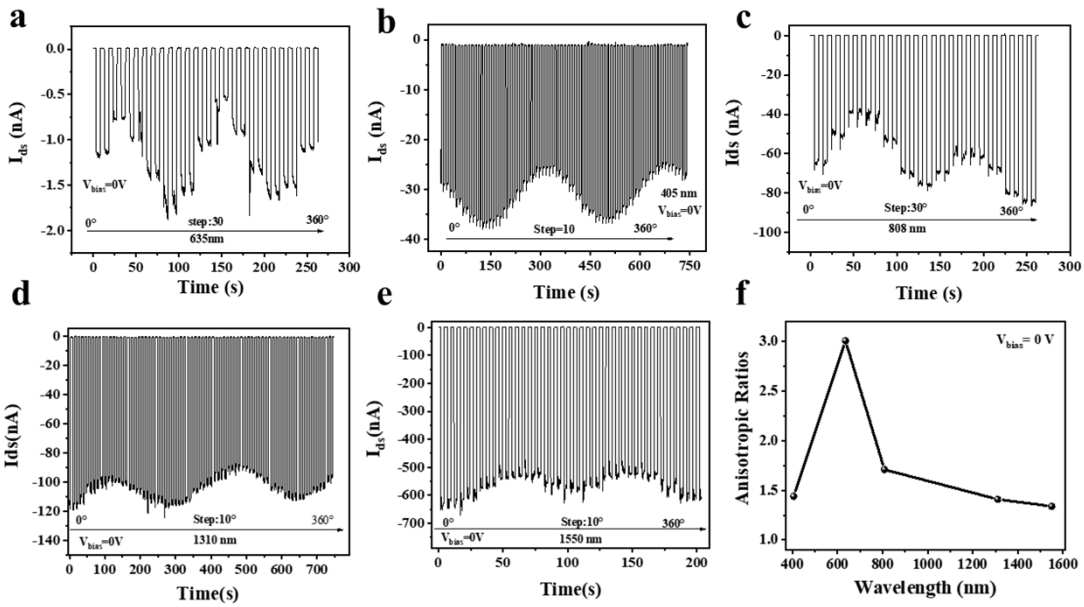

Figure S9. (a,b,c,d,e) The time resolved photocurrent of Ge/InSe heterojunction under polarized light with varying polarization angle from 0°to 360°under 635 nm (light power: 0.024 mW) , 405nm (light power: 1.93 mW), 808 nm (light power: 0.3 mW) , 1310 nm (light power: 1.11 mW) and 1550 nm (light power: 6.67 mW) light illumination. (f) indicates the polarization ratio versus wavelength.

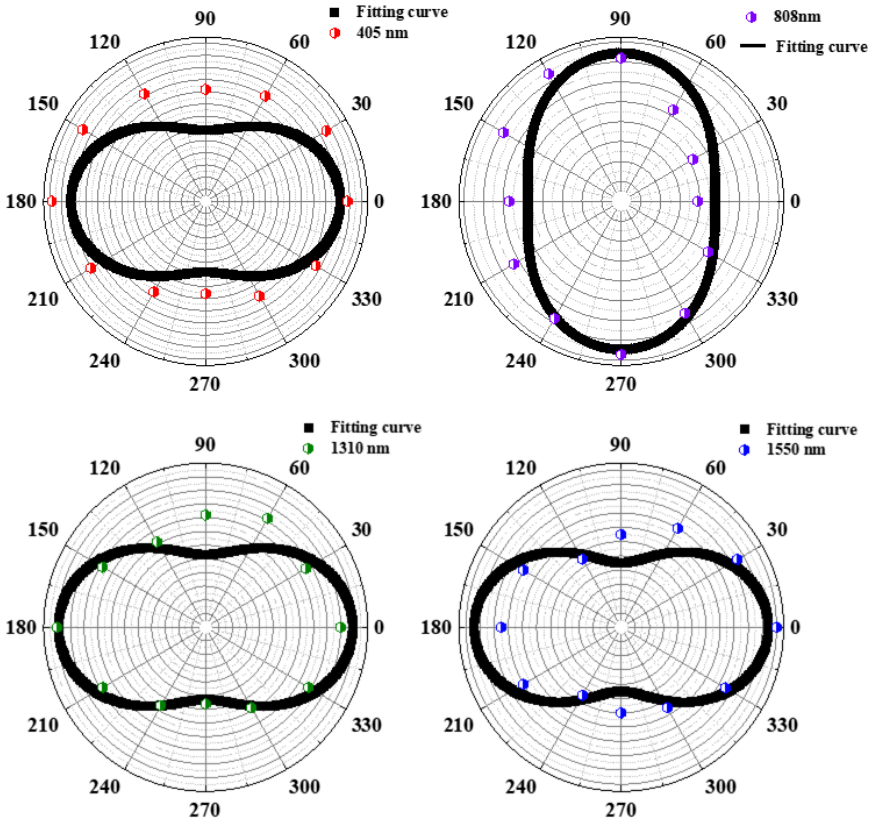

Figure S10. (a,b,c,d) Polar plots of the normalized photocurrents of Ge/InSe heterojunctions at 405, 808, 1310 and 1550 nm at zero bias voltage.

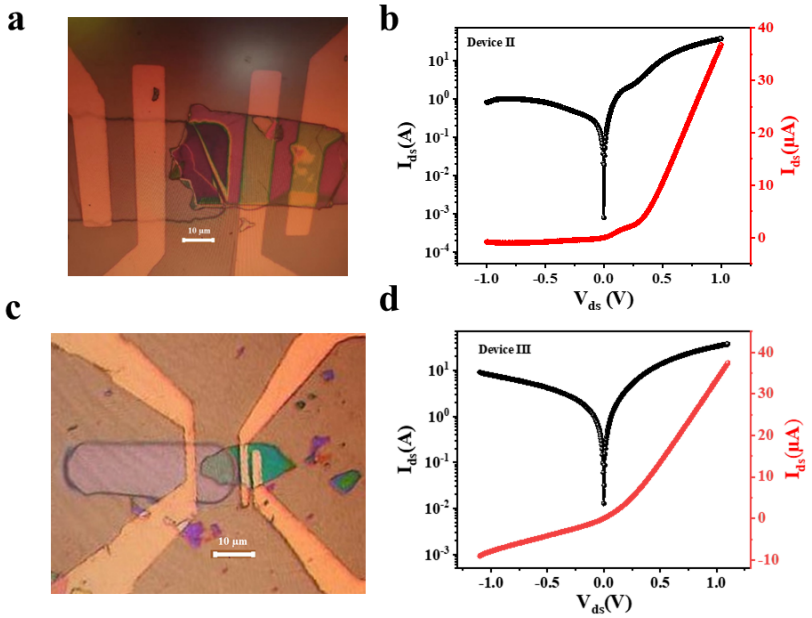

Figure S11. Optical image of (a) Device II and (b) Device III. I_{ds}-V_{ds} curves of (b) Device II and (d) Device III in darkness.

Table S1. Comparison of device performance of the present device with other similar Ge-based photodetectors.

Device	λ(nm)	Self-power	Polarization sensitivity	R(A/W)	D*(Jones)	Raise/fall time(μs)	ref
InSe/Ge	405-1550	yes	3.01	9.82(1550nm) 0.8(405nm)	5.4×10^{11} (1550nm) 4.8×10^{10} (405nm)	46/32	This work
Graphene/Ge	1200-1600	yes	/	0.051	1.38×10^{10}	23/108	1
PtSe2/Ge	405-2200	yes	/	0.602	6.31×10^{11}	7.42/16.71	2
$PdSe_2$/Ge	<2200	yes	/	0.53	1.45×10^{11}	25.4/38.5	3
WS_2/AIO_x/Ge	200-4600	yes	/	0.6345	4.3×10^{11}	9.8/12.7	4
WSe2/Ge	520-1550	yes	/	1.3	2.5×10^{10}	30/5	5
MoTe2/Ge	915-1550	yes	/	0.19	1.15×10^{11}	8/6	6

References

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