Supporting information

Broadband Full-Stokes Polarimeter based on ReS_2 Nanobelts

Tinghao Lin[1], Wendian Yao[2], Zeyi Liu[2], Haizhen Wang[3], Dehui Li[1, 2,] and Xinliang Zhang [1,*]*

[1]Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, 430074, China

[2]School of Optical and Electronic Information, Huazhong University of Science and Technology, Wuhan, 430074, China

[3]School of integrated circuit, Huazhong University of Science and Technology, Wuhan, 430074, China

*Corresponding author. Email: *dehuili@hust.edu.cn* *and* *xlzhang@mail.hust.edu.cn*

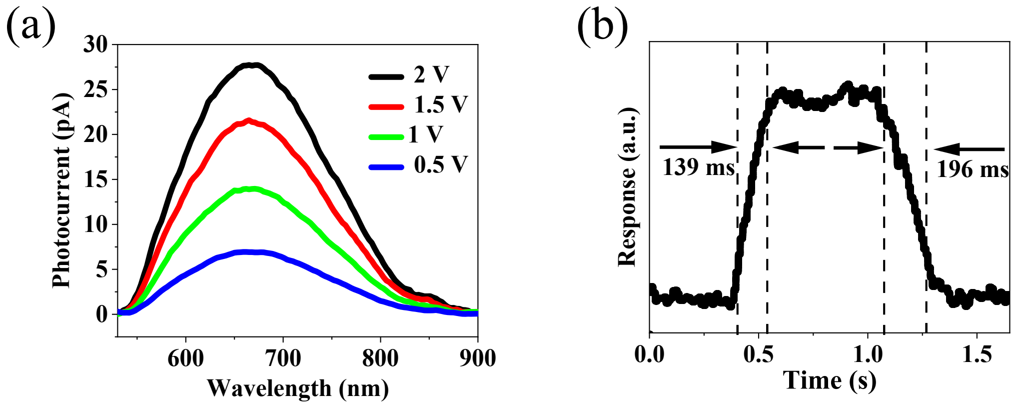

Fig. S1. (a) The spectral response of the ReS_2 device under biases of 2, 1.5, 1 and 0.5 V. (b) The response speed of the device measured by an oscilloscope under a bias voltage of 0.5 V illuminated by a 665 nm light.

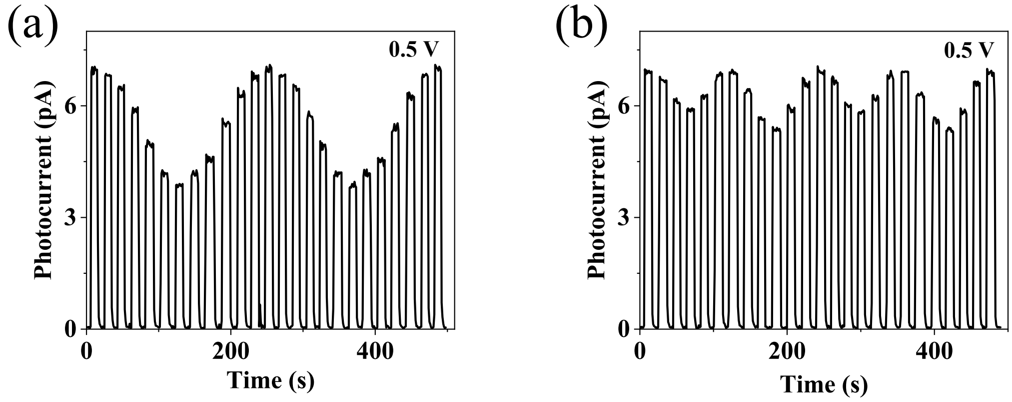

Fig. S2. (a) Time-dependent photoresponse with polarization direction of incident light from 0–360° under a 665 nm light excitation. (b) The time-dependent photocurrent with the incident light from 0–360° by rotating quart-wave plate under a 665 nm light illumination.

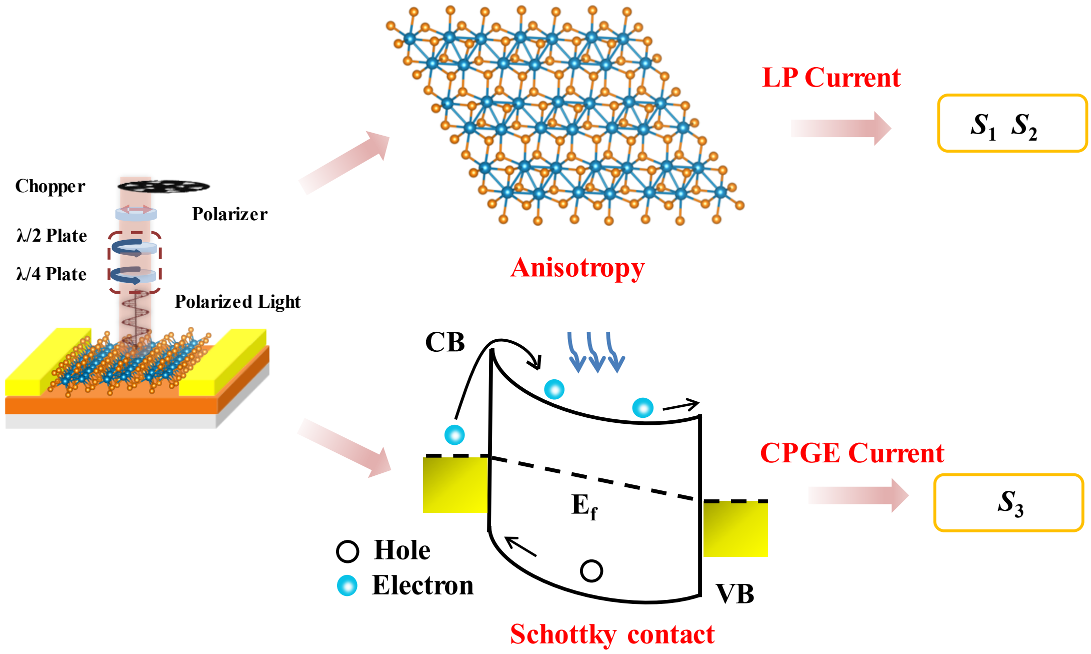

Fig. S3. The schematic illustration of the measurement mechanism for the ReS_2 nanobelt full-Stokes polarimeter[1-3].

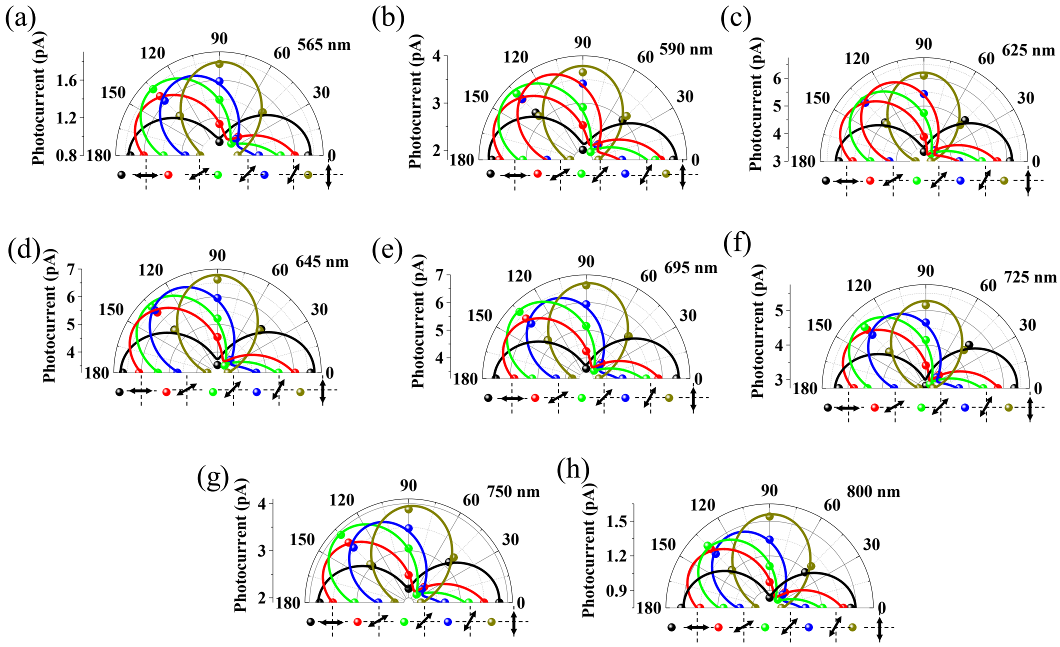

Fig. S4. Measured photocurrent of ReS_2 nanobelt device under five different linearly polarized light with different wavelength illumination when the rotation angle is set to 0°, 45°, 90°, 135° and 180°.

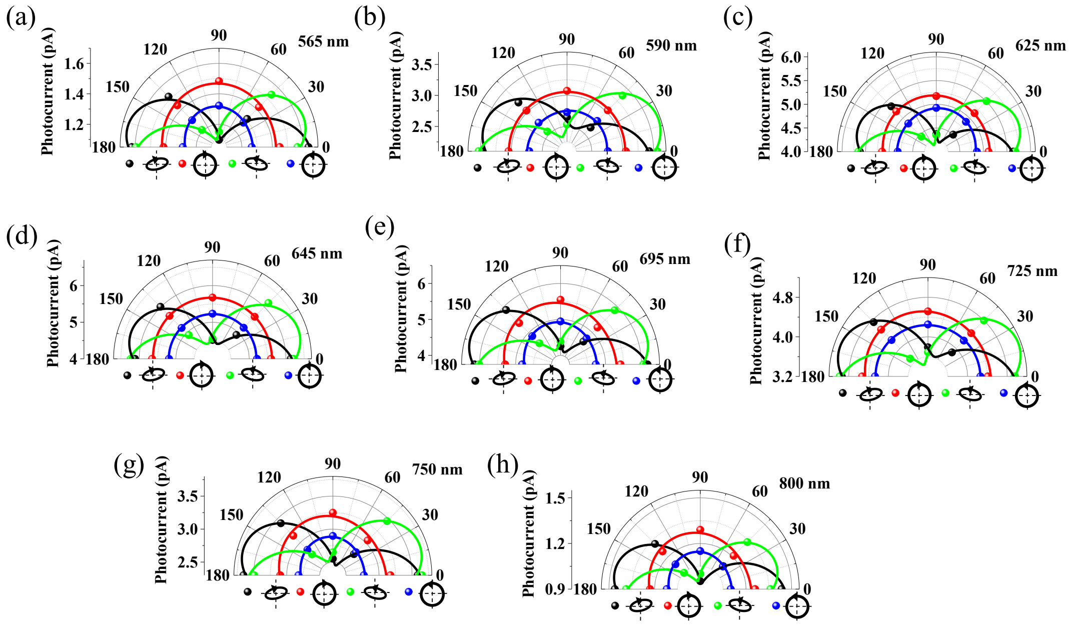

Fig. S5. Measured photocurrent of ReS_2 nanobelt device under different polarized (elliptically and circularly polarized) light with different wavelength illumination when the rotation angle is set to 0°, 45°, 90°, 135° and 180°.

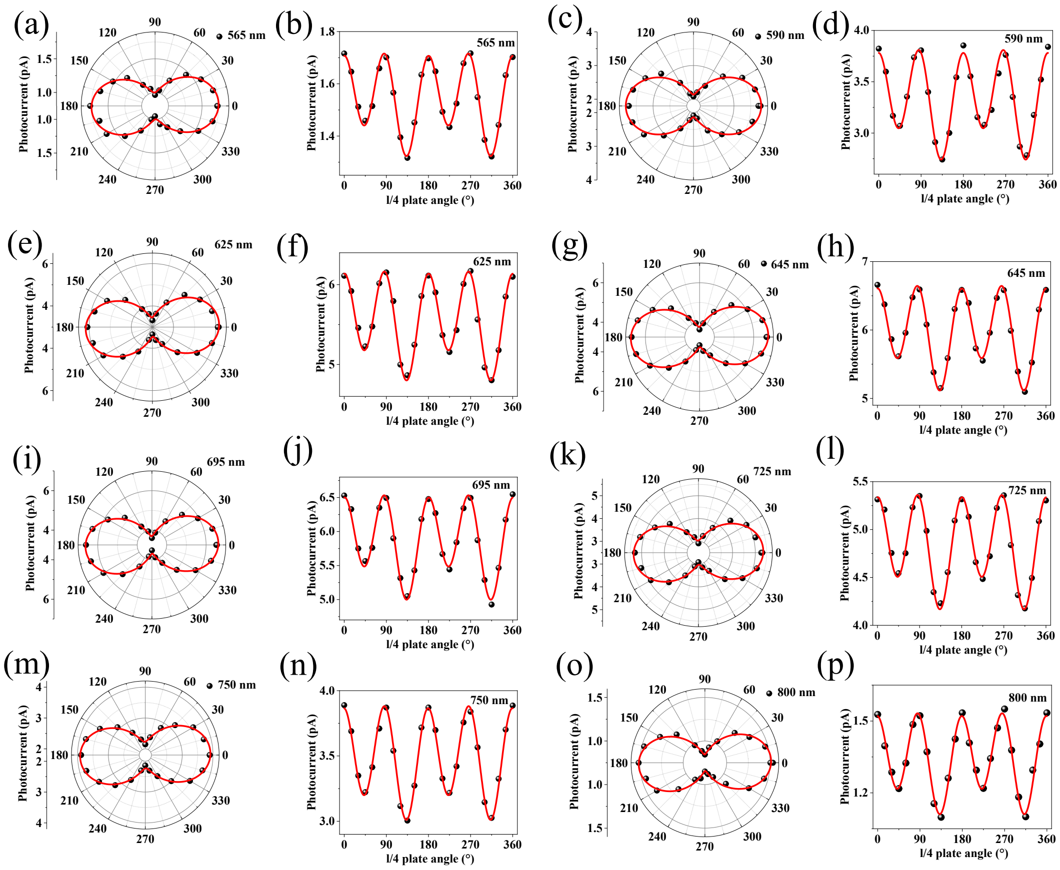

Fig. S6. The plot of the photocurrent versus the polarization angle in the polar coordinate with different wavelength illumination and the photocurrent as a function of the quarter-wave plate angle with different wavelength illumination.

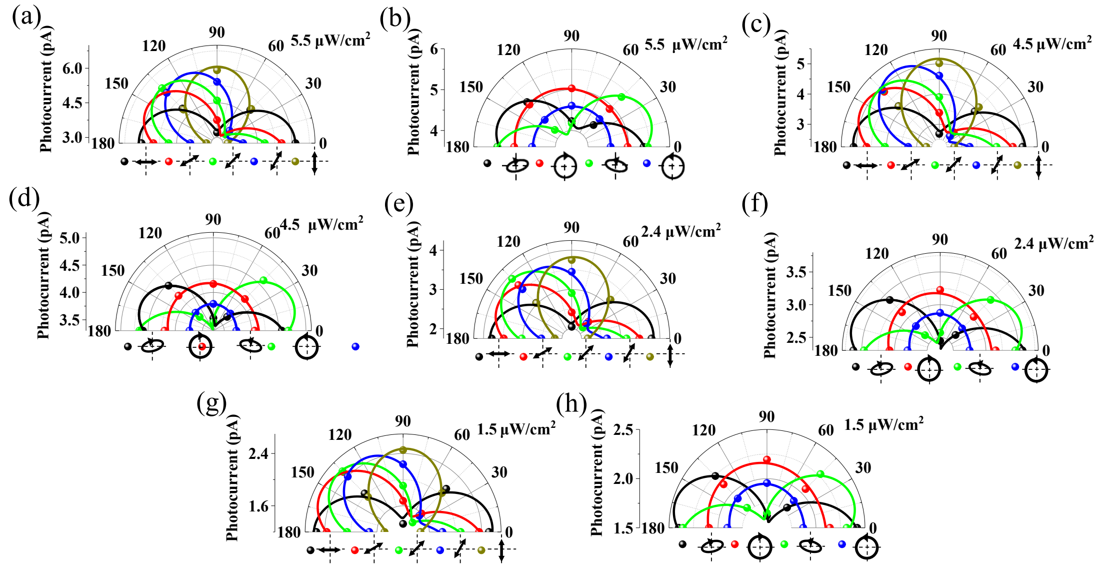

Fig. S7. Measured photocurrent of ReS_2 nanobelt device under different polarized (elliptically and circularly polarized) light with different power intensity illumination when the rotation angle is set to 0°, 45°, 90°, 135° and 180°.

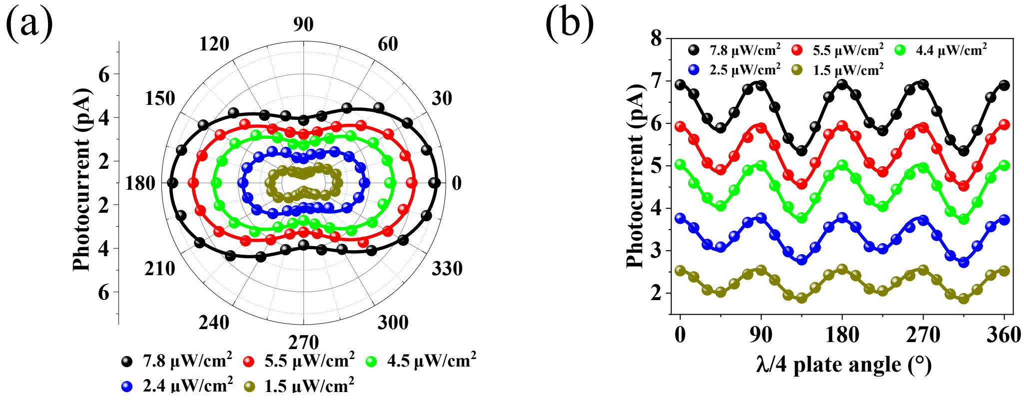

Fig. S8. The plot of the photocurrent versus the polarization angle in the polar coordinate under different power density illumination and the photocurrent as a function of the quarter-wave plate angle under different power density illumination.

Table S1. Performance of the reported on polarization-sensitive photodetectors based on two-dimensional materials

Material	linear dichroism	Wavelength (nm)	Responsivity	Ref
$ReSe_2$	2	633	1.5 mA/W	[4]
GeSe	2.2	808	1.6×10^5 A/W	[5]
GeS_2	2.1	325	-	[6]
GeP	1.8	532	3.11 A/W	[7]
$PdSe_2$	2.2	369	14.5	[8]
NbS_3	1.8	830	0.025	[9]
Our work	1.8	665	181 A/W	

References

[1] J. Quereda, J. Hidding, T. S. Ghiasi, et al. The role of device asymmetries and schottky barriers on the helicity-dependent photoresponse of 2D phototransistors. NPJ 2D Materials and Applications, 2021, 5: 13

[2] E. J. M. Sajal Dhara, Ritesh Agarwal. Voltage-tunable circular photogalvanic effect in silicon nanowires. Science, 2015, 349: 726

[3] Y. Xiong, Y. Wang, R. Zhu, et al. Twisted black phosphorus–based van der Waals stacks for fiber-integrated polarimeters. Science Advances, 2022, 8: eabo0375

[4] E. Zhang, P. Wang, Z. Li, et al. Tunable ambipolar polarization-sensitive photodetectors based on high-anisotropy $ReSe_2$ nanosheets. ACS Nano, 2016, 10: 8067

[5] X. Wang, Y. Li, L. Huang, et al. Short-Wave Near-Infrared Linear Dichroism of Two-Dimensional Germanium Selenide. Journal of the American Chemical Society, 2017, 139: 14976

[6] Y. Yang, S. Liu, X. Wang, et al. Polarization-sensitive ultraviolet photodetection of anisotropic 2D GeS_2. Advanced Functional Materials, 2019, 29: 1900411

[7] L. Li, W. Wang, P. Gong, et al. 2D GeP: An Unexploited Low-Symmetry Semiconductor with Strong In-Plane Anisotropy. Advanced Materials, 2018, 30: 1706771

[8] L. Pi, C. Hu, W. Shen, et al. Highly In-Plane Anisotropic 2D $PdSe_2$ for Polarized Photodetection with Orientation Selectivity. Advanced Functional Materials, 2020, 31(3): 2006774

[9] Y. Wang, P. Wu, Z. Wang, et al. Air-Stable Low-Symmetry Narrow-Bandgap 2D Sulfide Niobium for Polarization Photodetection. Advanced Materials, 2020, 32(45): 2005037