

Supplementary Information (SI) for

**A single silicon nanostripe gated suspended monolayer and bilayer WS₂ to
realize abnormal electro-optical modulation**

Jiahao Yan, Churong Ma, Yingcong Huang & Guowei Yang*

State Key Laboratory of Optoelectronic Materials and Technologies, Nanotechnology

Research Center, School of Materials Science & Engineering, Sun Yat-sen University,

Guangzhou 510275, Guangdong, P. R. China

*Corresponding author: stsygw@mail.sysu.edu.cn

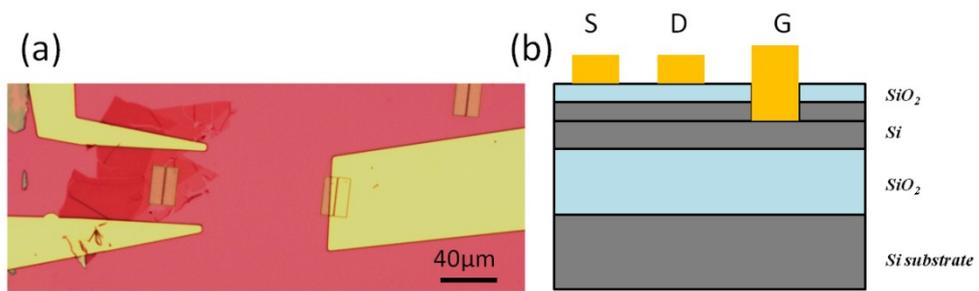


Figure S1. (a) The optical image of the electrically controlled WS₂-Si nanostripe hybrid device under small magnification. (b) Cross section of the device to reveal how voltages apply.

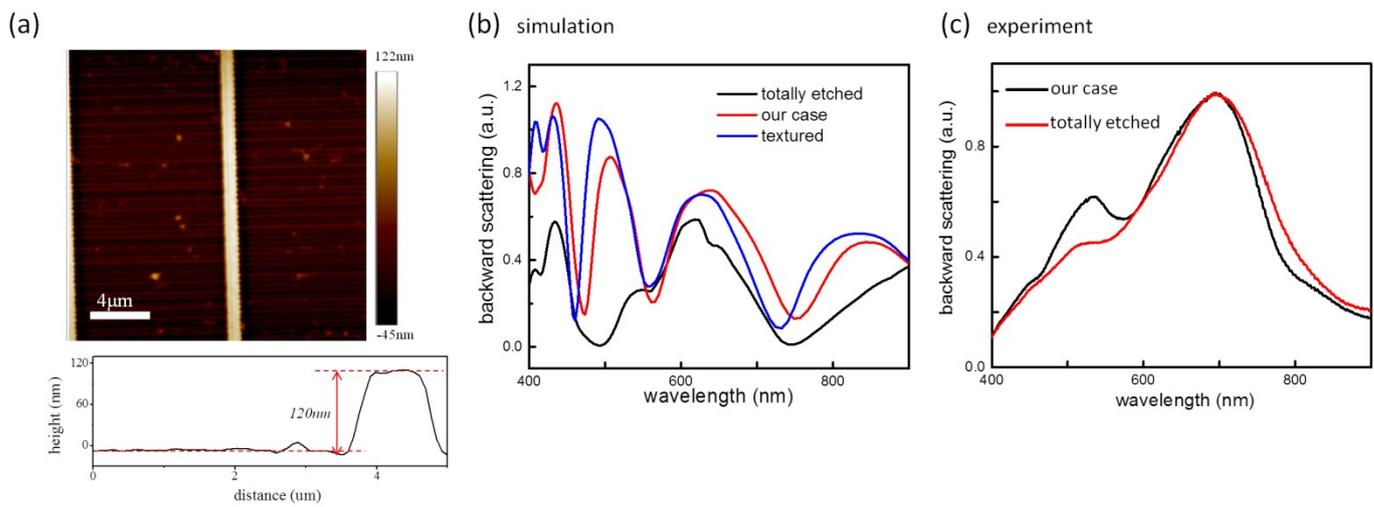


Figure S2. (a) AFM image and line scan of the Si nanostripe. (b) Simulated scattering spectra of totally etched, less etched (our case) Si nanostripes and the nanostripe on textured substrate (height=10 nm, pitch=300 nm). (c) Experimental scattering spectra of totally etched and partially etched Si nanostripes.

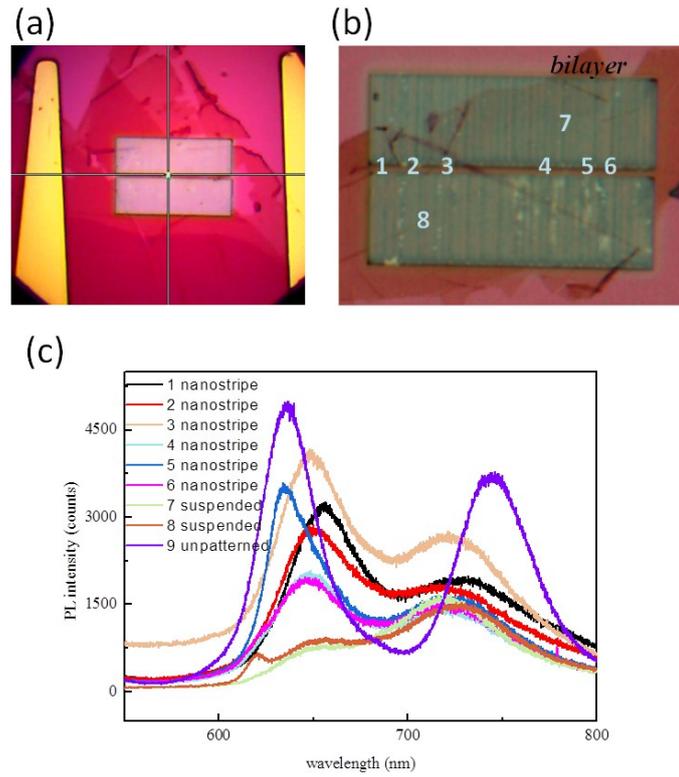


Figure S3. (a) An optical image of detect area under the confocal microscope with the laser spot on the Si nanostripe. (b) Optical image showing the detection points on the other bilayer sample. (c) PL spectra of different positions marked in (b).

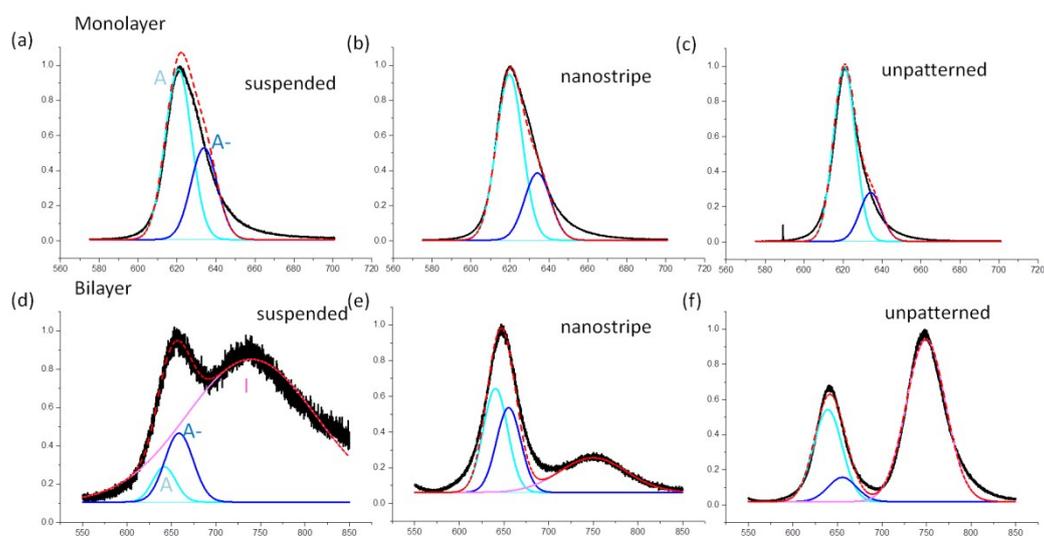


Figure S4. (a-c) Exciton and trion states in suspended monolayer WS_2 (a), monolayer WS_2 on nanostripe (b) and on unpatterned region (c). (d-f) Exciton and trion states in suspended bilayer WS_2 (d), monolayer WS_2 on nanostripe (e) and on unpatterned region (f). Light blue and dark blue fit curves represent exciton and trion respectively.

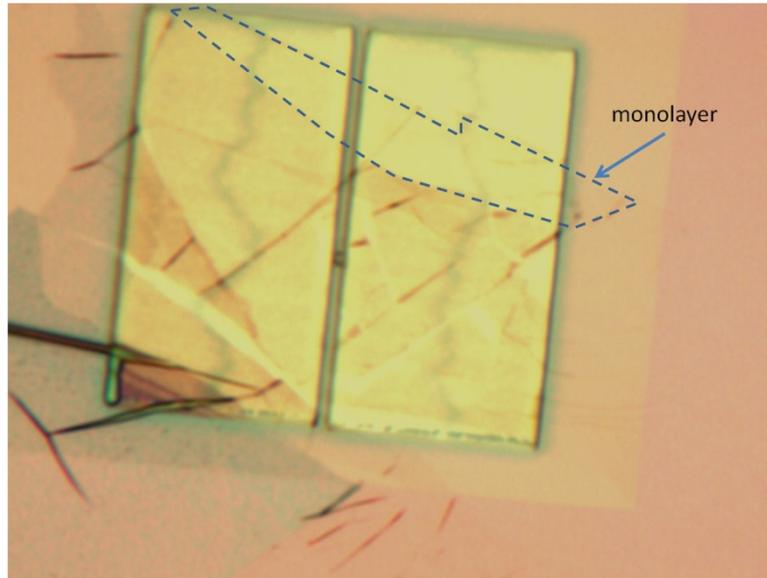


Figure S5. An optical image of WS₂ flakes transferred on bare SOI substrate without 30 nm oxide layer.

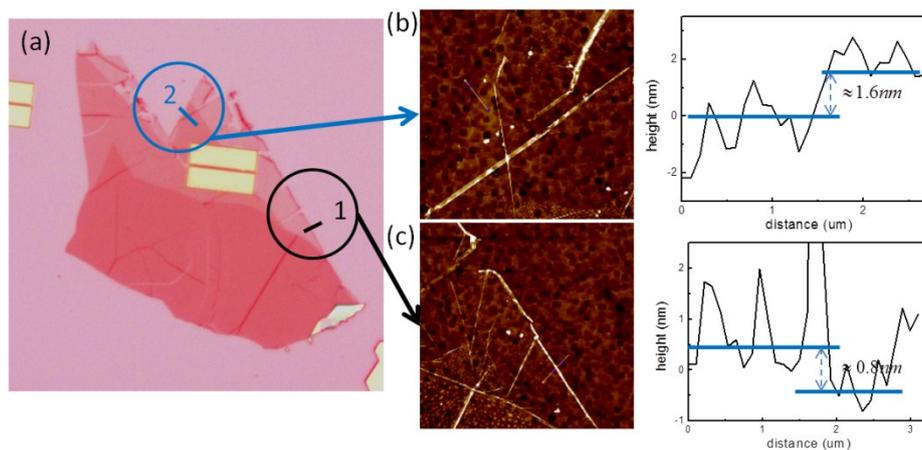


Figure S6. (a) The optical image of the measured sample in Fig. 1e and 2a. Circles and short lines show the area where AFM measurement was taken. (b) and (c) AFM images and the topographic line profiles.

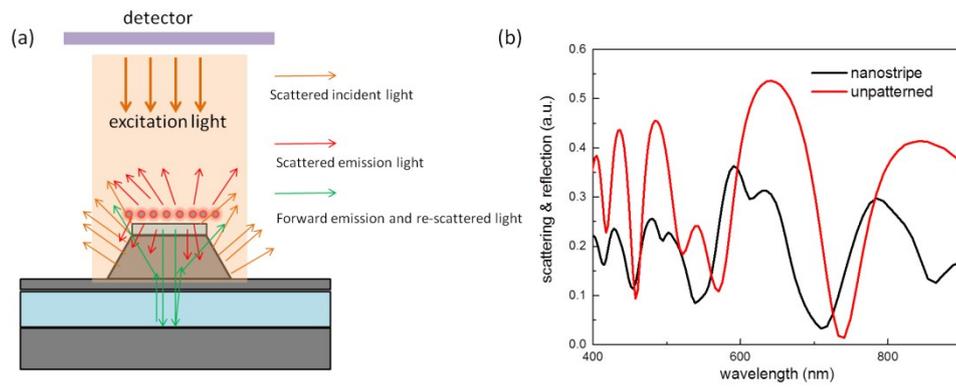


Figure S7. (a) Schematic showing why emission light from nanostructures is weaker than that from unpatterned region. (b) Simulated spectra after considering the trapezoid edges of nanostructure.

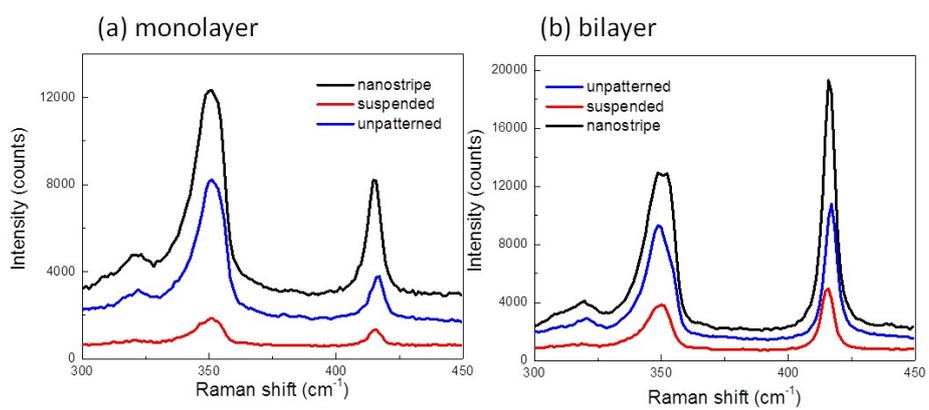


Figure S8. Raman spectra of monolayer (a) and bilayer (b) WS₂ at three different regions.