



**Extended Data Figure 3 | Optical properties of single-junction MoSe<sub>2</sub>-WSe<sub>2</sub> lateral heterostructure.** **a, b**, Raman spectra of MoSe<sub>2</sub> and WSe<sub>2</sub> domains from a single-junction MoSe<sub>2</sub>-WSe<sub>2</sub> monolayer lateral heterostructure using 514 nm (**a**) and 613 nm (**b**) laser excitation. **c**, Raman spectra at the interfaces of the single-junction MoSe<sub>2</sub>-WSe<sub>2</sub> lateral heterostructure. **d, e**, Composite Raman intensity maps at a frequency of 240 cm<sup>-1</sup> (MoSe<sub>2</sub> domain, **d**), 250 cm<sup>-1</sup> (WSe<sub>2</sub> domain, **e**). **f**, Position map corresponding to the optical image in Extended Data

Fig. 2a. **g**, Photoluminescence spectra of MoSe<sub>2</sub>, WSe<sub>2</sub> domains and at the interface of the MoSe<sub>2</sub>-WSe<sub>2</sub> single-junction monolayer lateral heterostructure shown in Extended Data Fig. 2a. **h-j**, Photoluminescence intensity maps at 1.53 eV (MoSe<sub>2</sub> domain, **h**) and 1.6 eV (WSe<sub>2</sub> domain, **i**); the composite is shown in **j**. **k, l**, Peak width (in eV) map (**k**) and position (in eV) map (**l**) corresponding to the optical image in Extended Data Fig. 2a. Scale bars: **d-l**, 10  $\mu\text{m}$ .