

Spin grating on MoSe<sub>2</sub>

# Transient Grating Spectroscopy

- interference of two pump pulses creates sinusoidal excitation pattern
- diffracted probe beam probes evolution (diffusion)

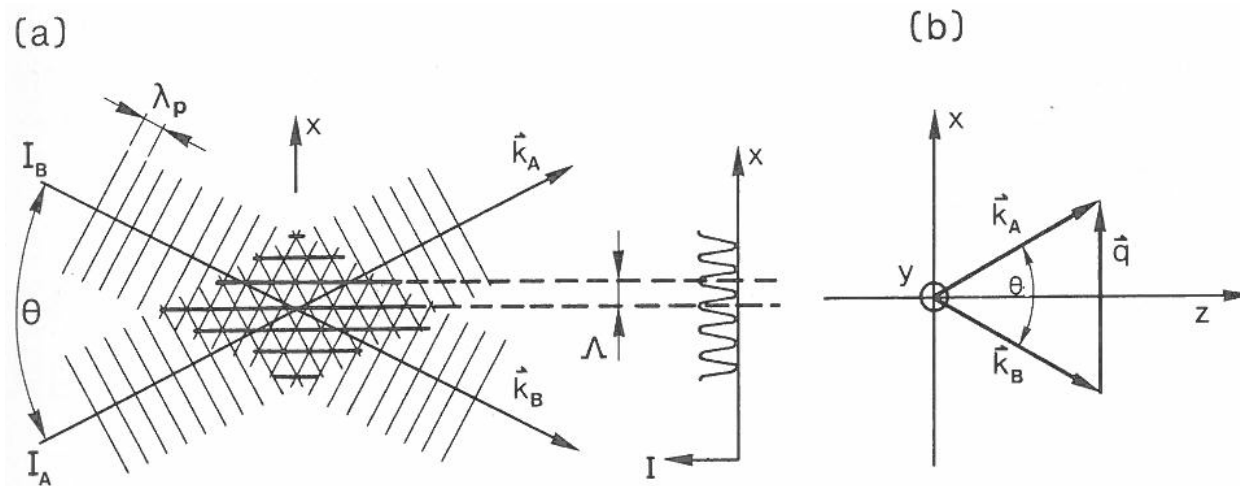
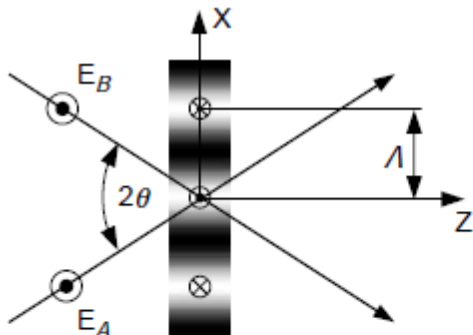


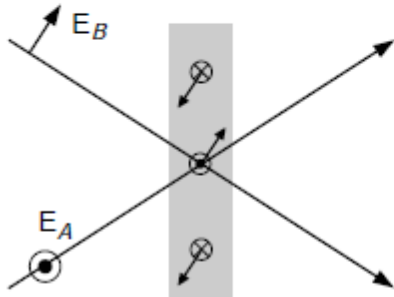
Fig. 2.2a,b. Grating production by interference of two light waves with intensities  $I_A$ ,  $I_B$  and wave vectors  $\vec{k}_A$  and  $\vec{k}_B$

# Transient Grating Spectroscopy

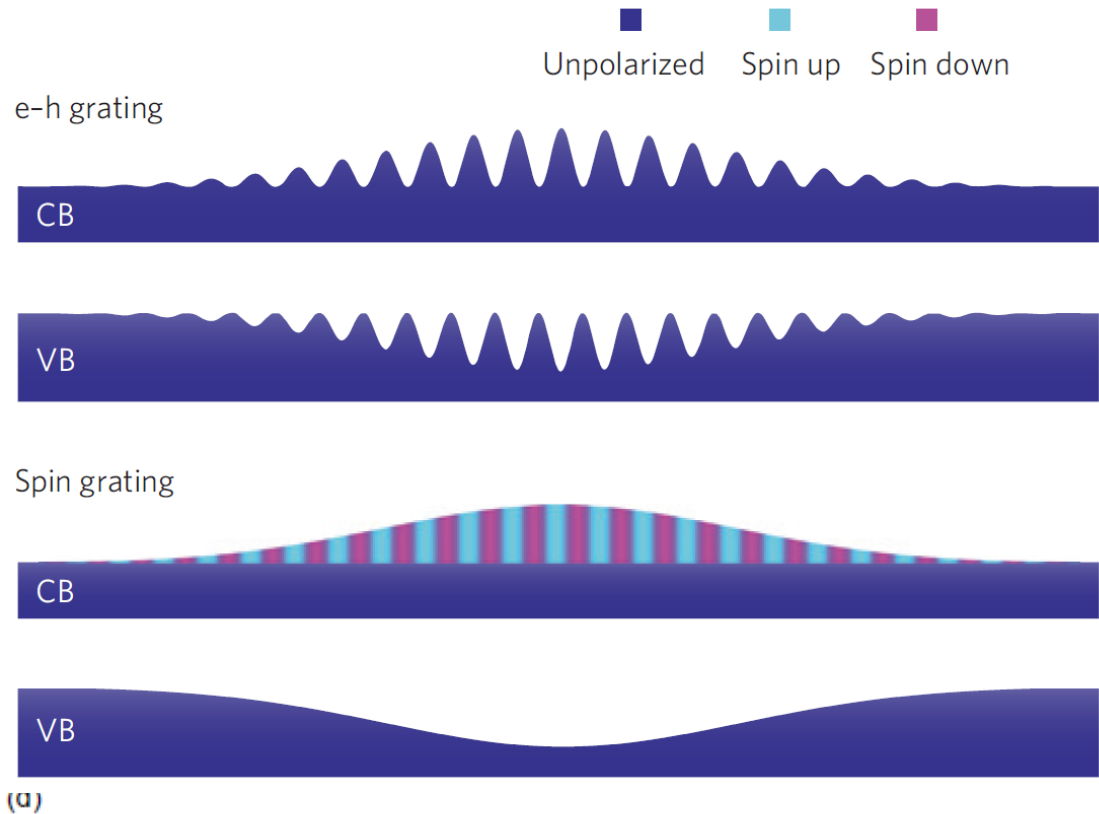
- different kinds of gratings are possible



(a)



(c)



# Transient Grating Spectroscopy

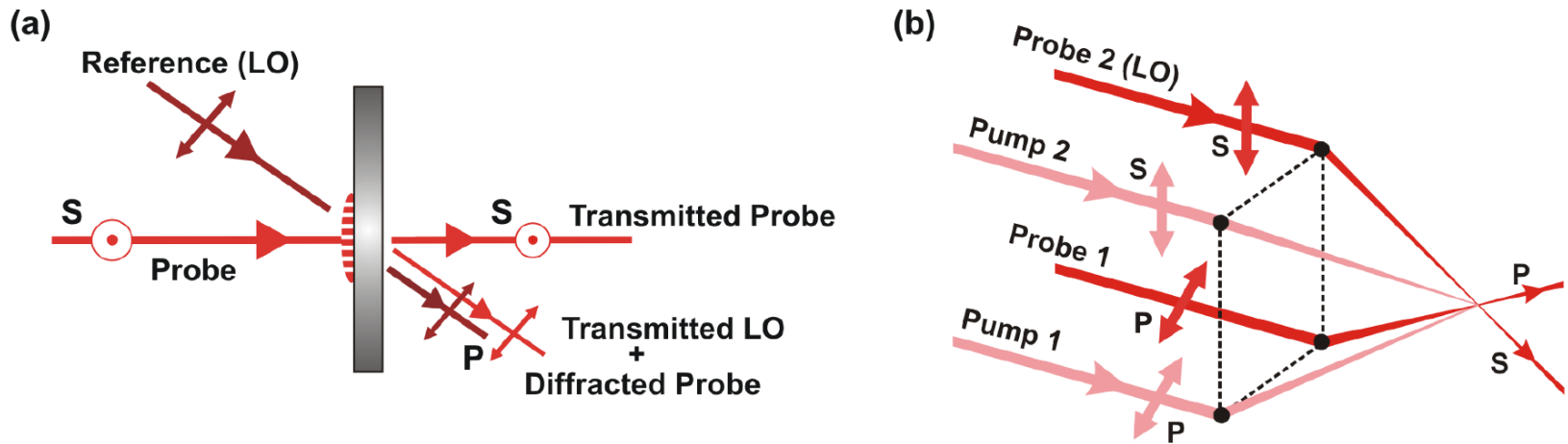
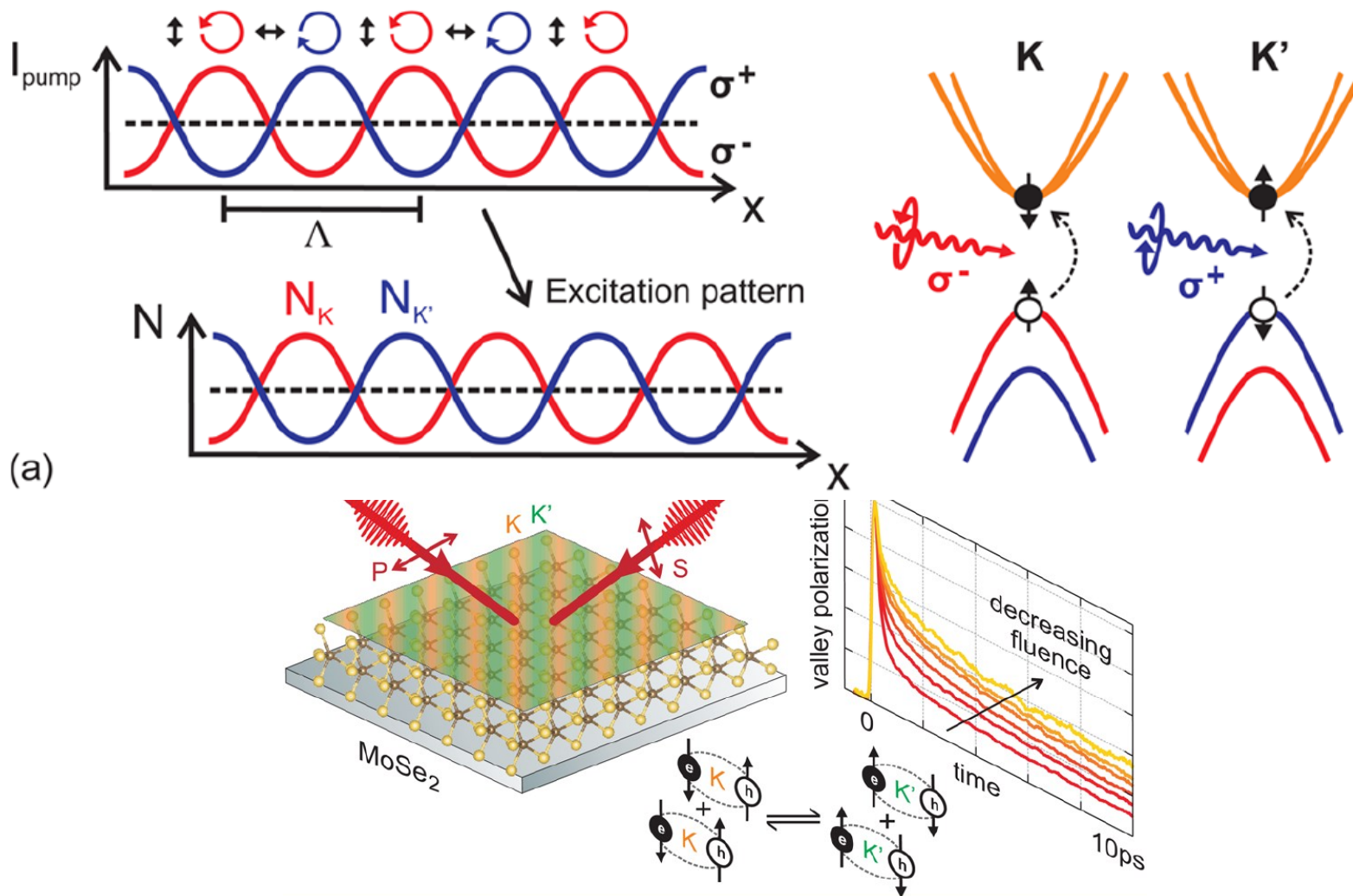


Figure S1. Transient spin grating (TSG): heterodyne detection & box-car setup. (a) The out-of-plane (S) polarized probe beam diffracts such that its polarization is rotated to be in-plane (P). The diffracted beam is mixed with a P-polarized local oscillator (LO) for heterodyne detection. (b) Box-car geometry for TSG.


# Observation of Exciton–Exciton Interaction Mediated Valley Depolarization in Monolayer MoSe<sub>2</sub>

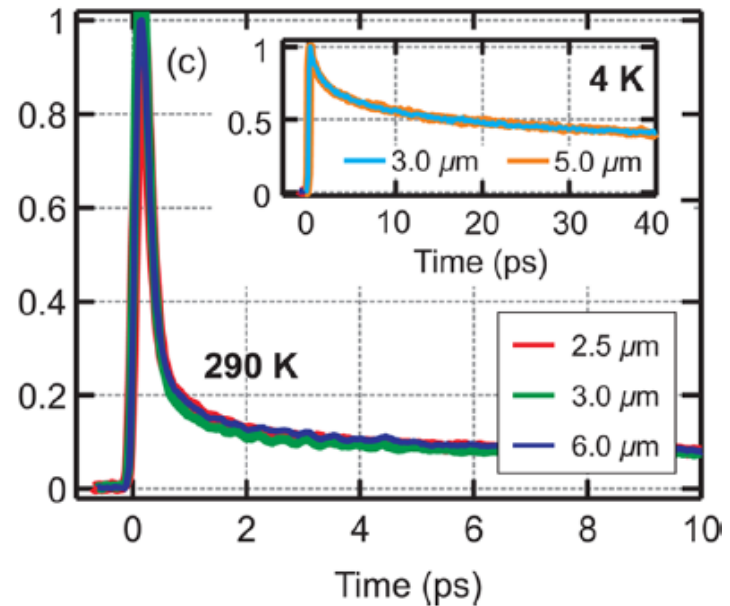
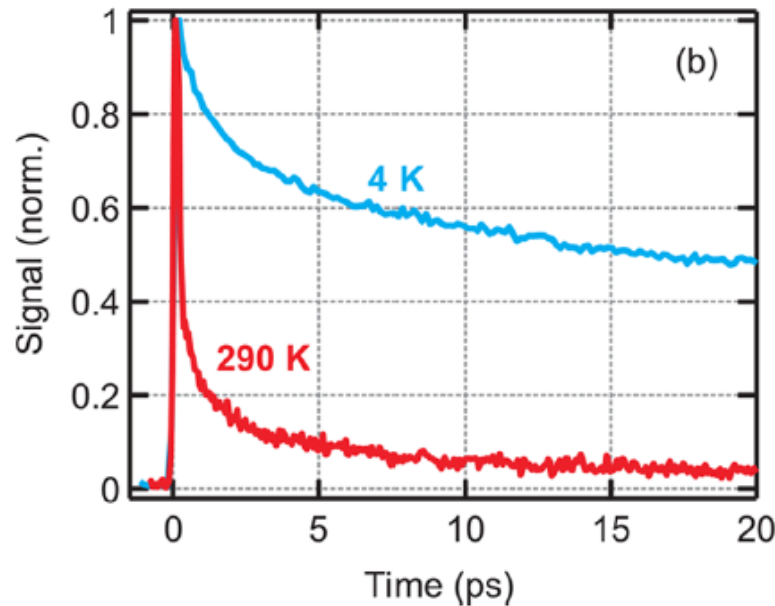
Fahad Mahmood,<sup>†</sup> Zhanybek Alpichshev,<sup>†</sup> Yi-Hsien Lee,<sup>‡</sup> Jing Kong,<sup>§</sup> and Nuh Gedik<sup>\*,†,||</sup>



from: N.Gedik, Nano Lett.2018, 223-228

# Observation of Exciton–Exciton Interaction Mediated Valley Depolarization in Monolayer MoSe<sub>2</sub>

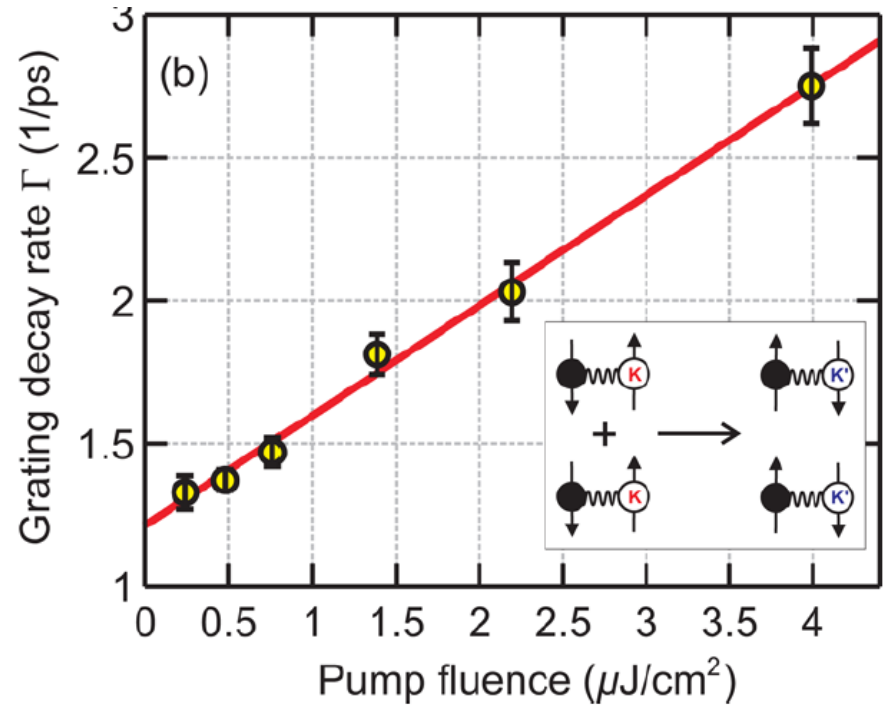
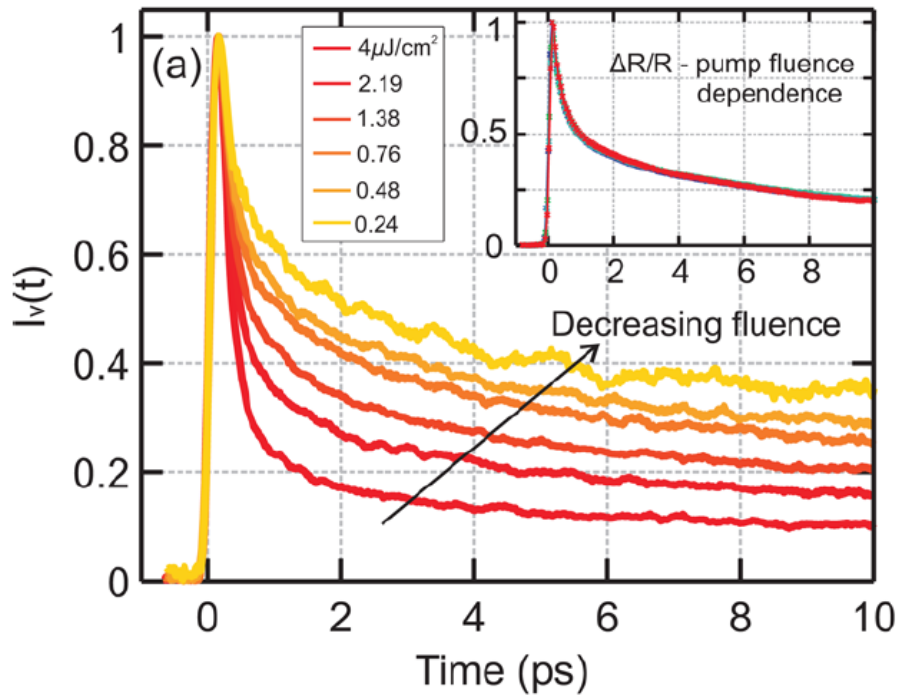
Fahad Mahmood,<sup>†</sup> Zhanybek Alpichshev,<sup>†</sup> Yi-Hsien Lee,<sup>‡</sup> Jing Kong,<sup>§</sup> and Nuh Gedik<sup>\*,†</sup> 



- faster decay at higher temperatures
- no dependence on periodicity => no (spin-)diffusion

# Observation of Exciton–Exciton Interaction Mediated Valley Depolarization in Monolayer MoSe<sub>2</sub>

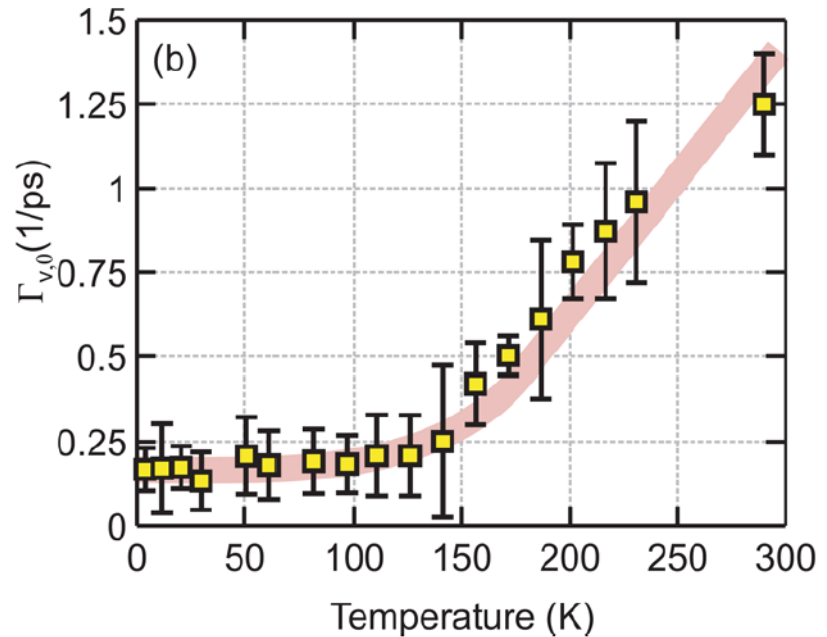
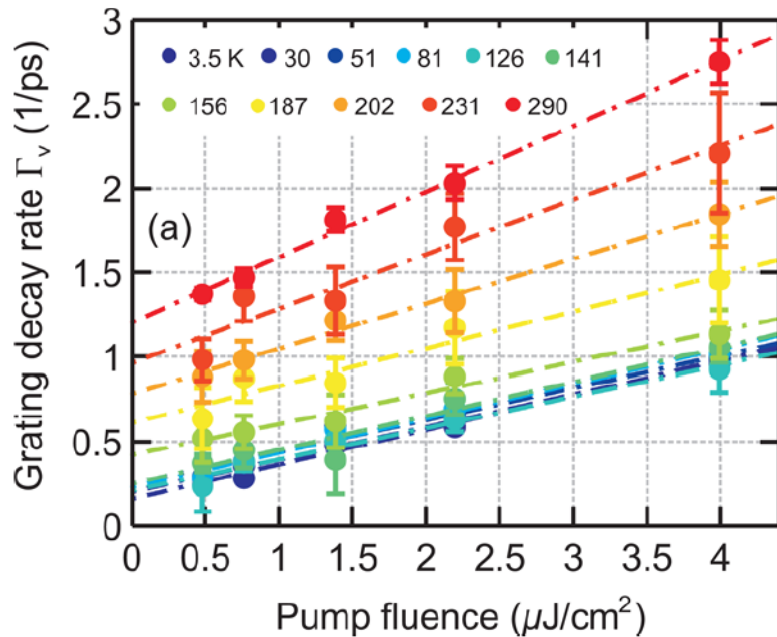
Fahad Mahmood,<sup>†</sup> Zhanybek Alpichshev,<sup>†</sup> Yi-Hsien Lee,<sup>‡</sup> Jing Kong,<sup>§</sup> and Nuh Gedik<sup>\*,†,||</sup>



- faster decay at higher fluences
- linear dependence on fluence

# Observation of Exciton–Exciton Interaction Mediated Valley Depolarization in Monolayer MoSe<sub>2</sub>

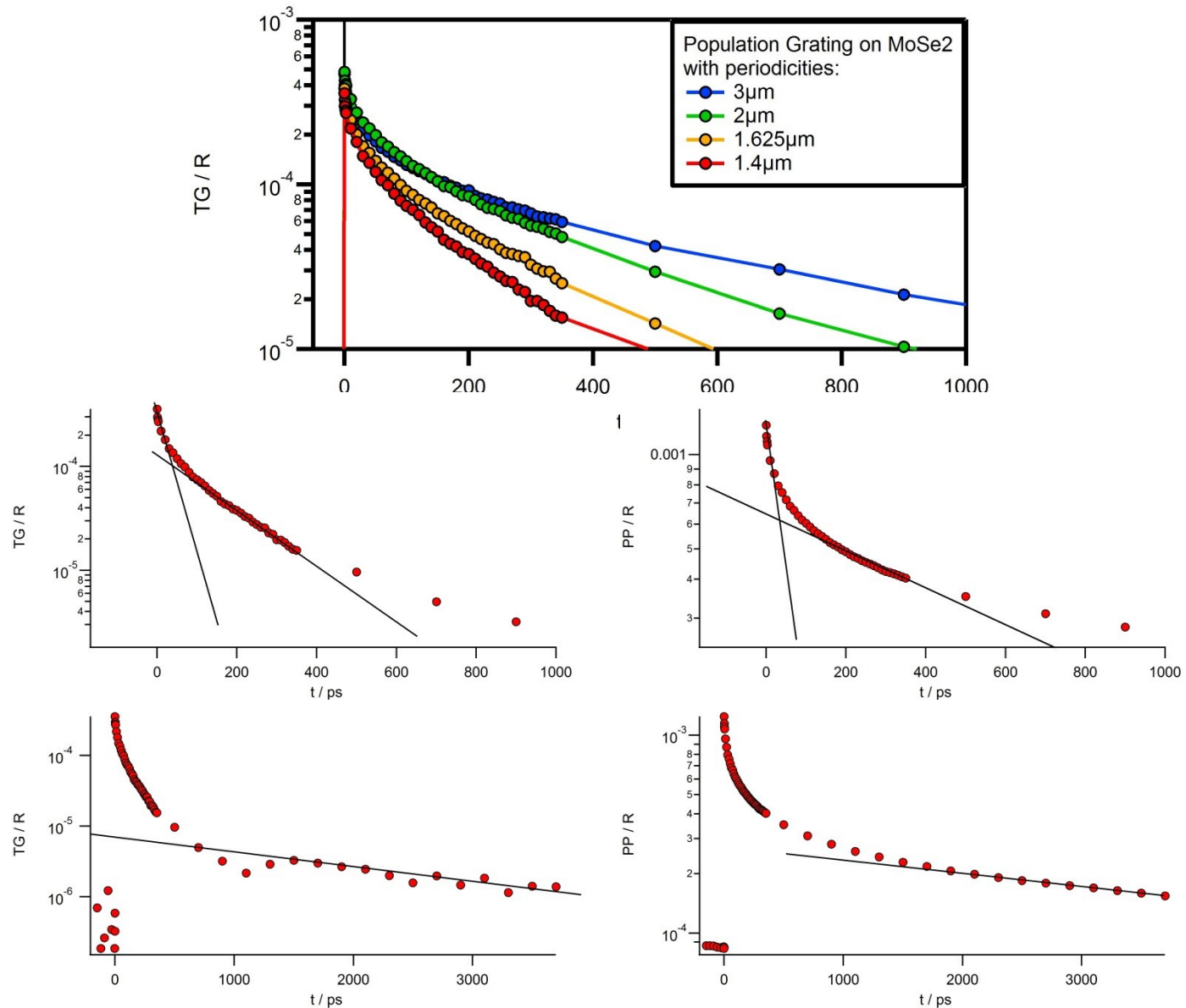
Fahad Mahmood,<sup>†</sup> Zhanybek Alpichshev,<sup>†</sup> Yi-Hsien Lee,<sup>‡</sup> Jing Kong,<sup>§</sup> and Nuh Gedik<sup>\*,†,||</sup>



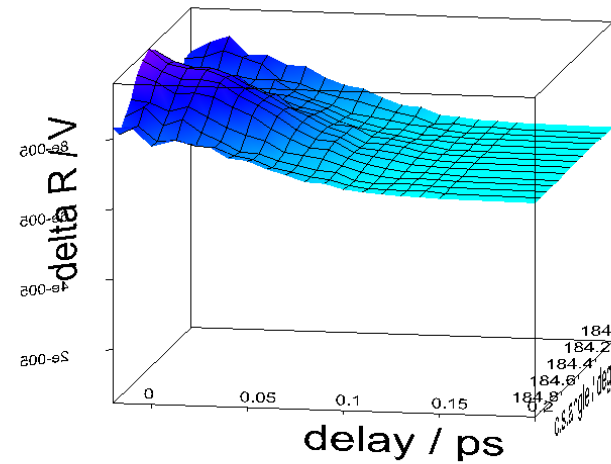
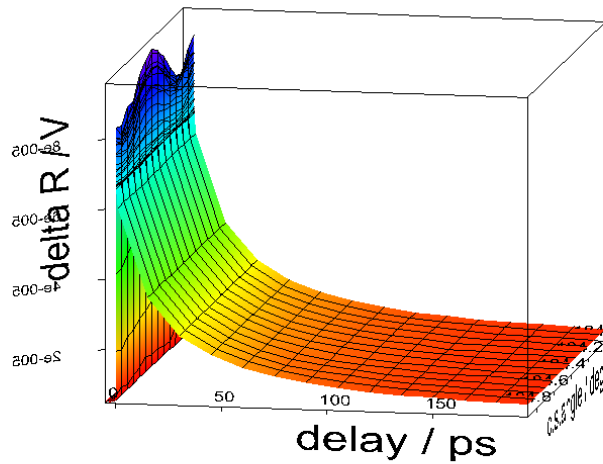
- faster decay at higher fluences
- linear dependence on fluence



# Own measurements (bulk, population)

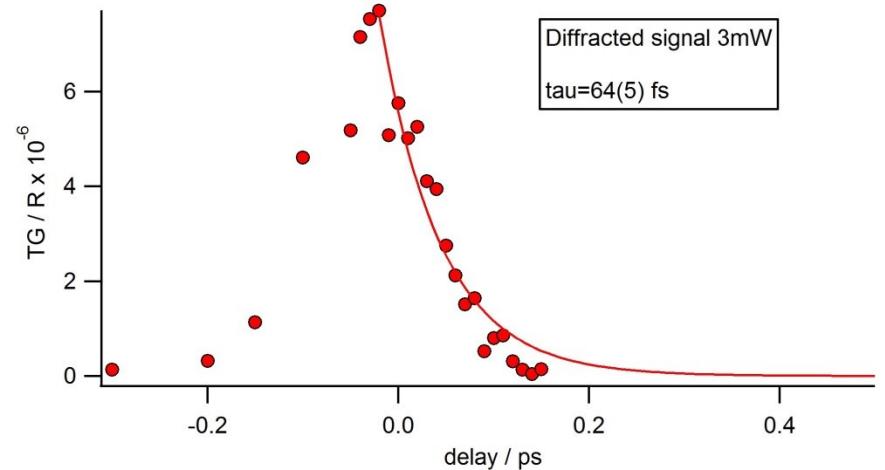
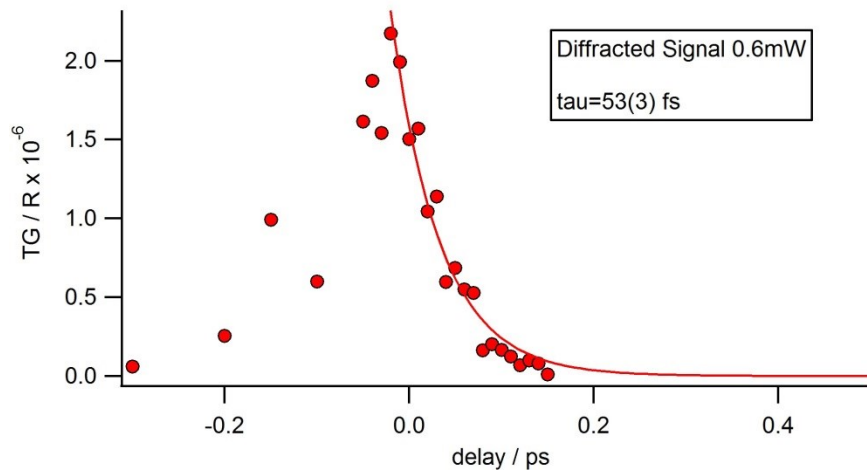


# Own measurements (ML, spin)



# Own measurements (ML, spin)

- no dependence on fluence?



- pulses too long!?! (113fs)

# Thank you

