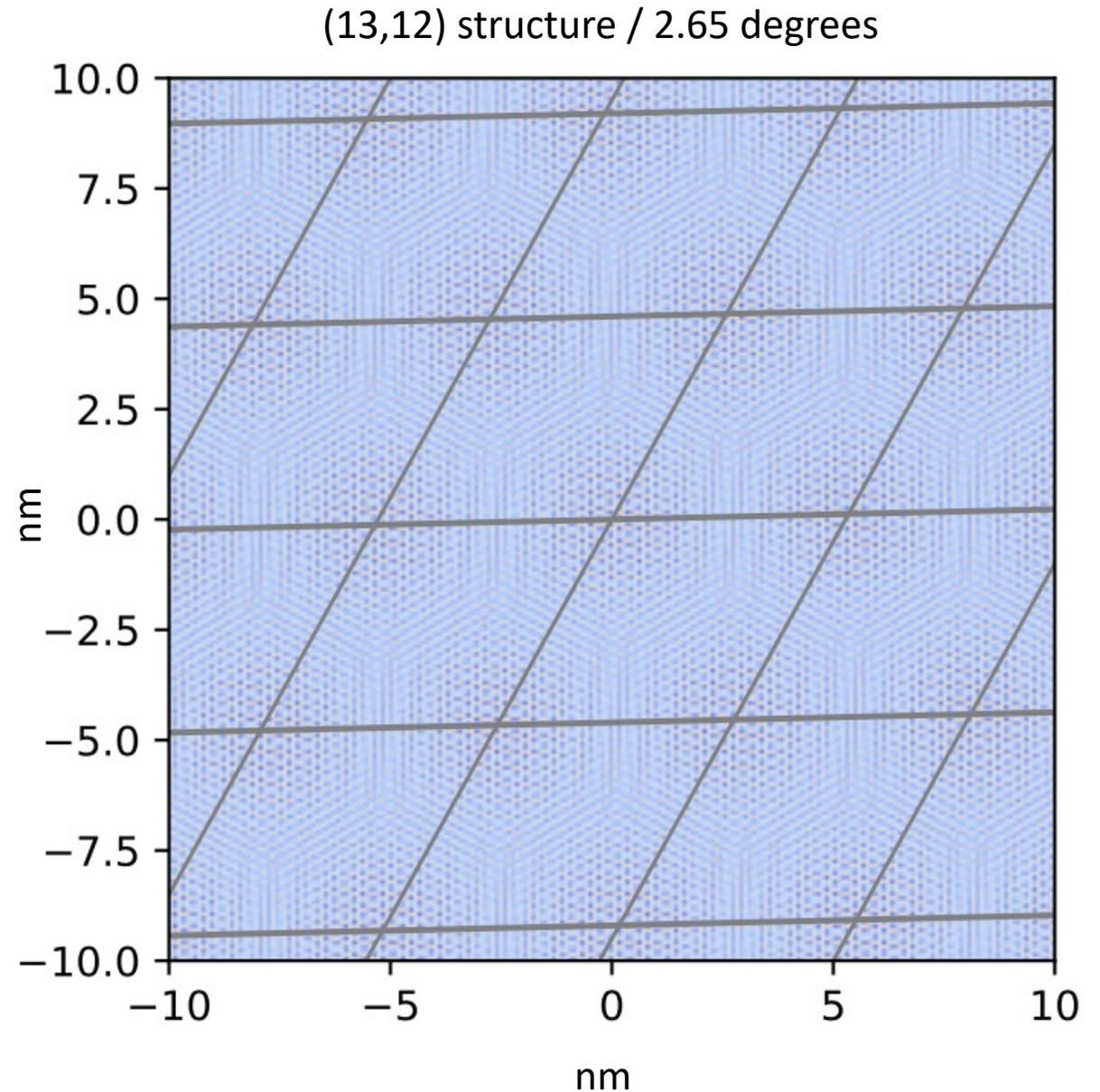# Fourier Amplitudes and Phases in TBG

Spenser Talkington

14 August 2023

Real space structure

- Here we consider a real space density given by Gaussians centered on atomic positions

- Top and bottom layers are treated equally

- We first treat a large unit cell structure for which there are AA/AB regions
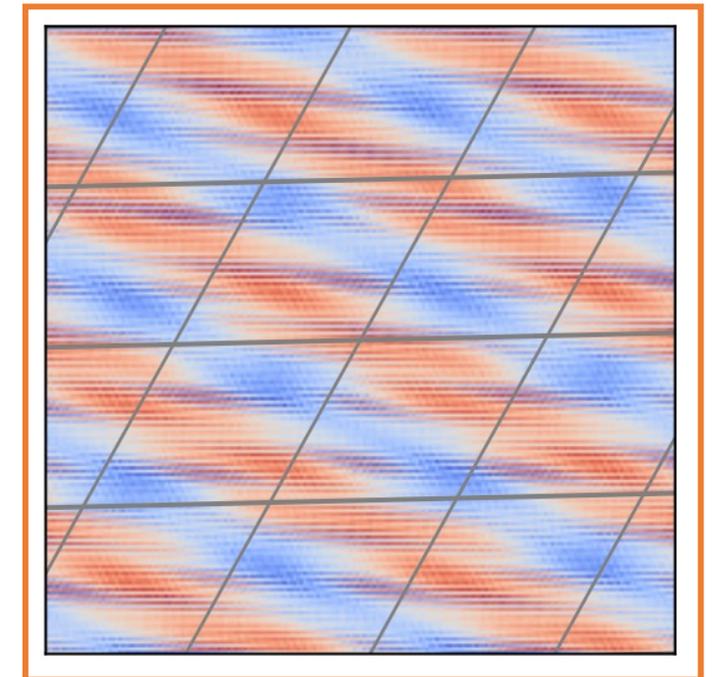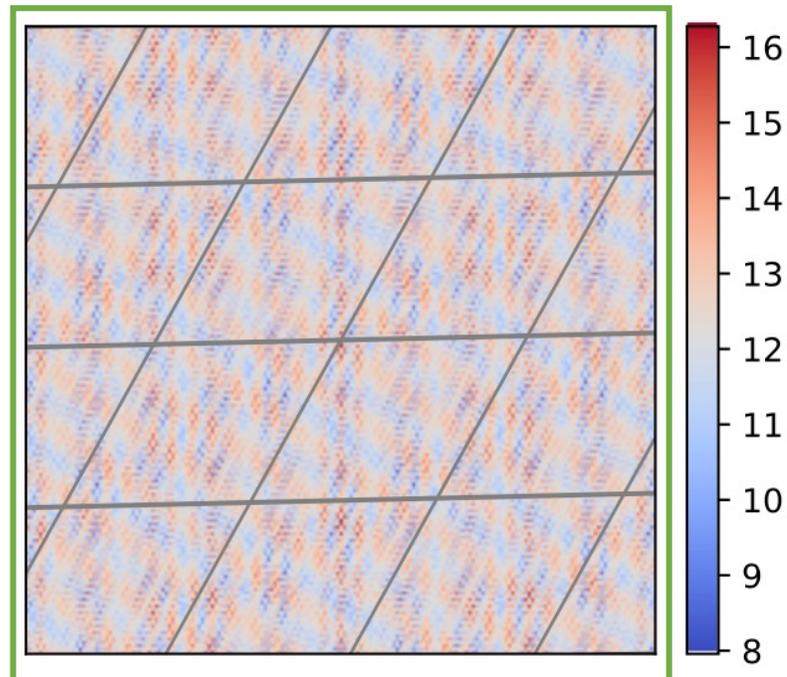
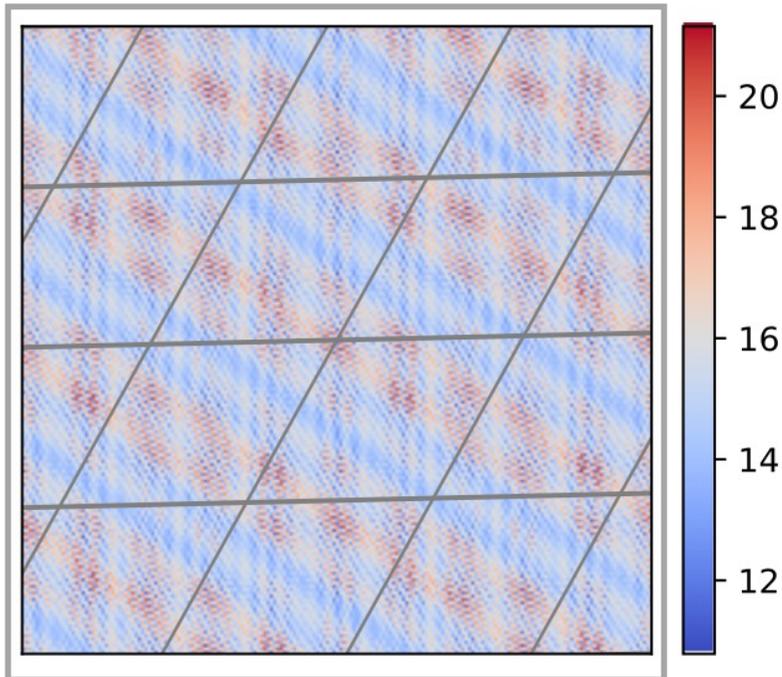(13,12) structure / 2.65 degrees

Fourier amplitudes

- We consider three sets of Fourier amplitudes as resolved in real space on 1 x 1 nm patches

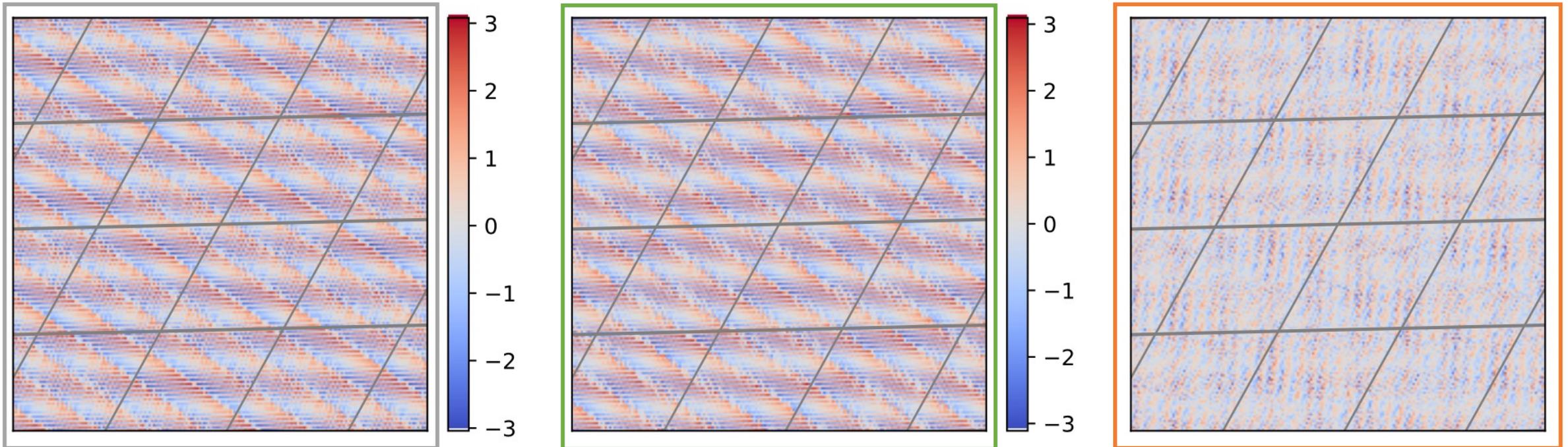- No attempt is made to center on atoms!
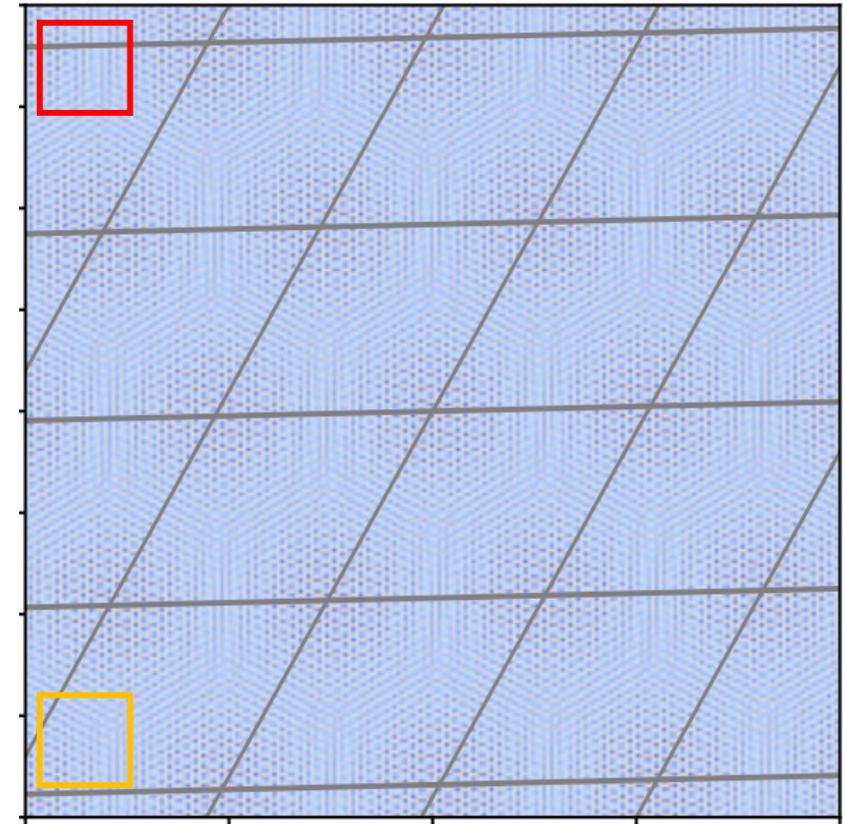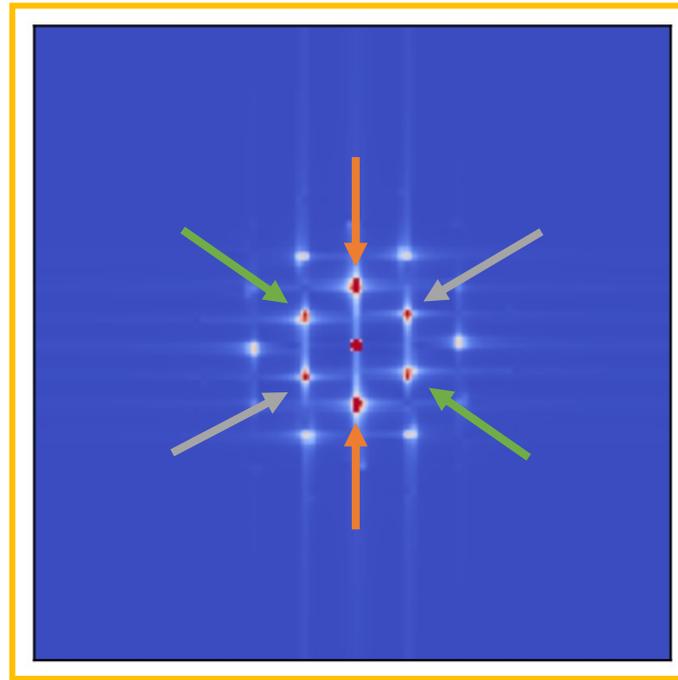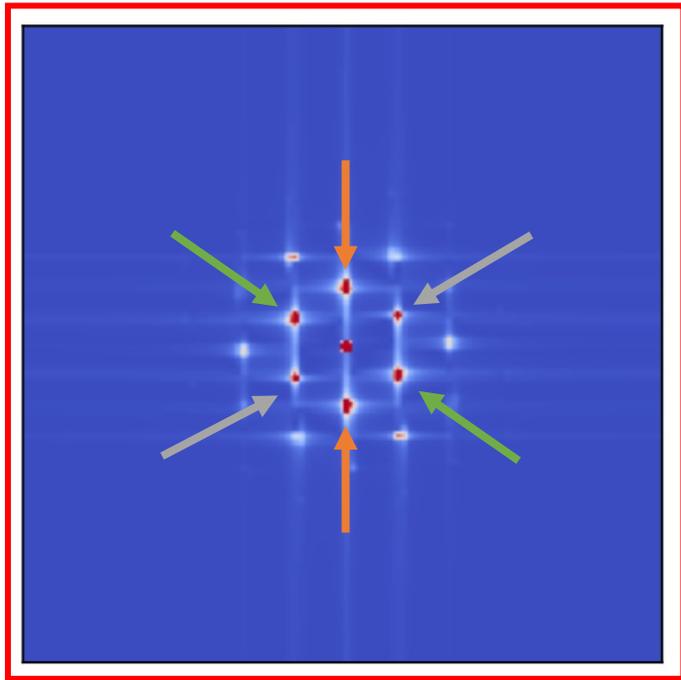
Amplitudes mapped to real space

- We note a modulation that is not the period of the Moire cell
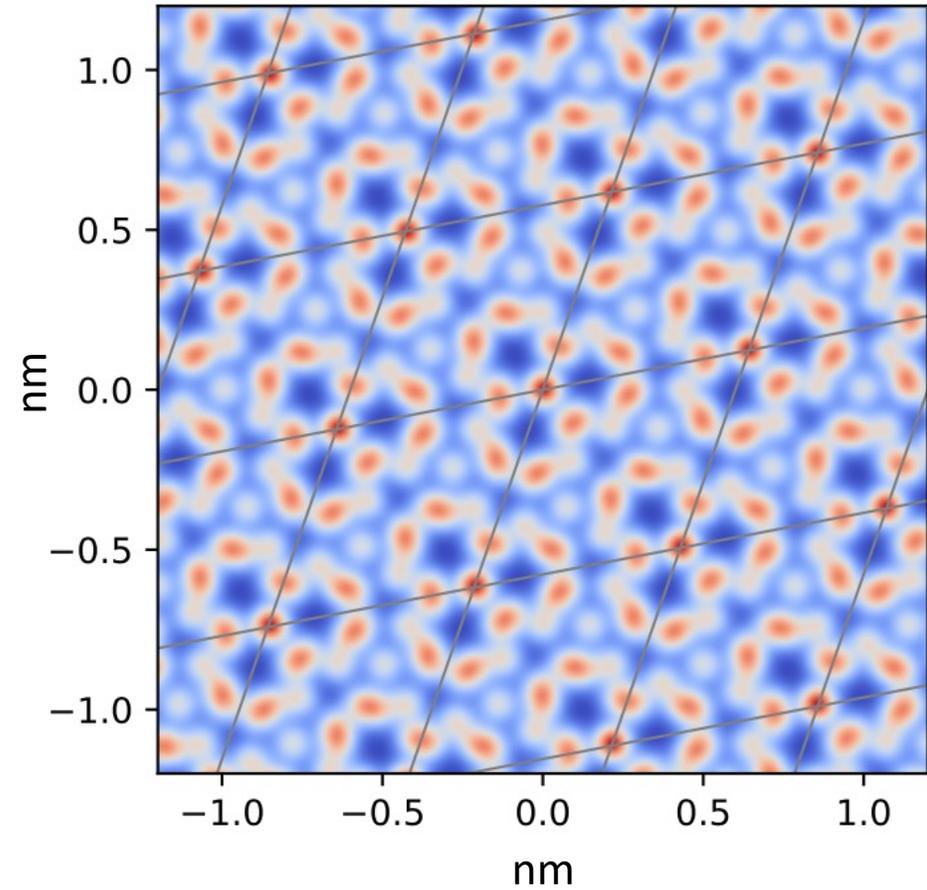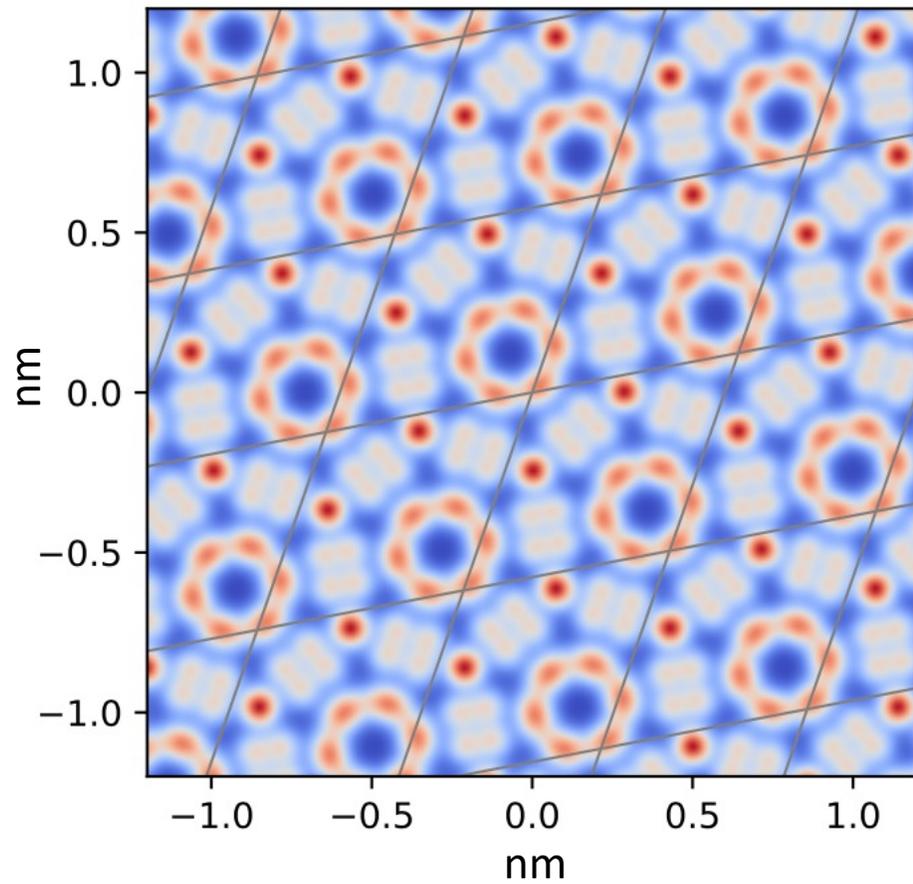- Gray lines are approximate

Phases mapped to real space

- We note a modulation that is not the period of the Moire cell
- We simply take the argument of the the Fourier amplitude
- Gray lines are approximate

Small unit cell structures

- We consider the even and odd structures

Fourier amplitudes

- We consider a similar situation to the large unit cell case where the "box" that is transformed is small to the unit cell size (but not tiny)

- Box = 0.12 nm

- We choose our "order parameter" locations to be in a circle

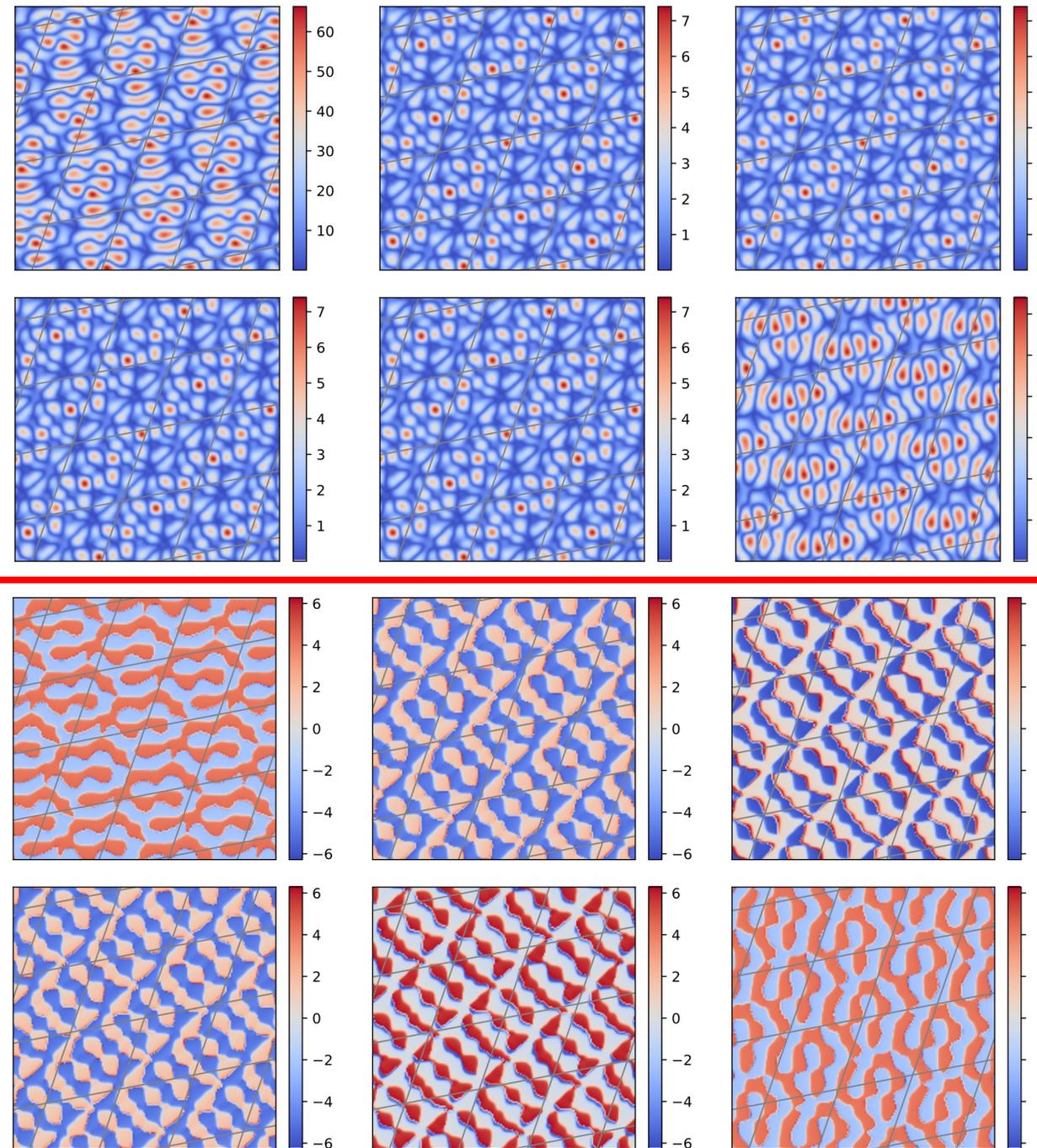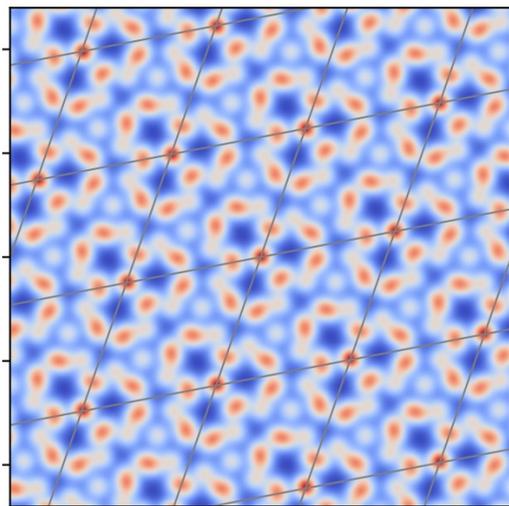- These locations don't correspond to peaks as they did at small angles
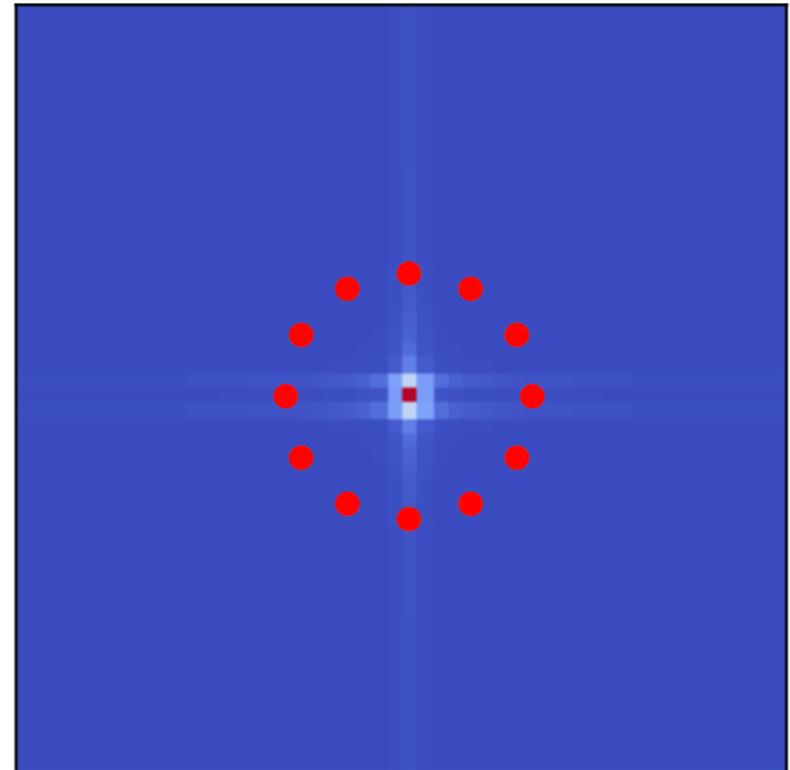
SE-Even

- Amplitudes (top)

- Phases (bottom)

- All seem to be incommensurate
  - But periodic with period *more* than the moire unit cell
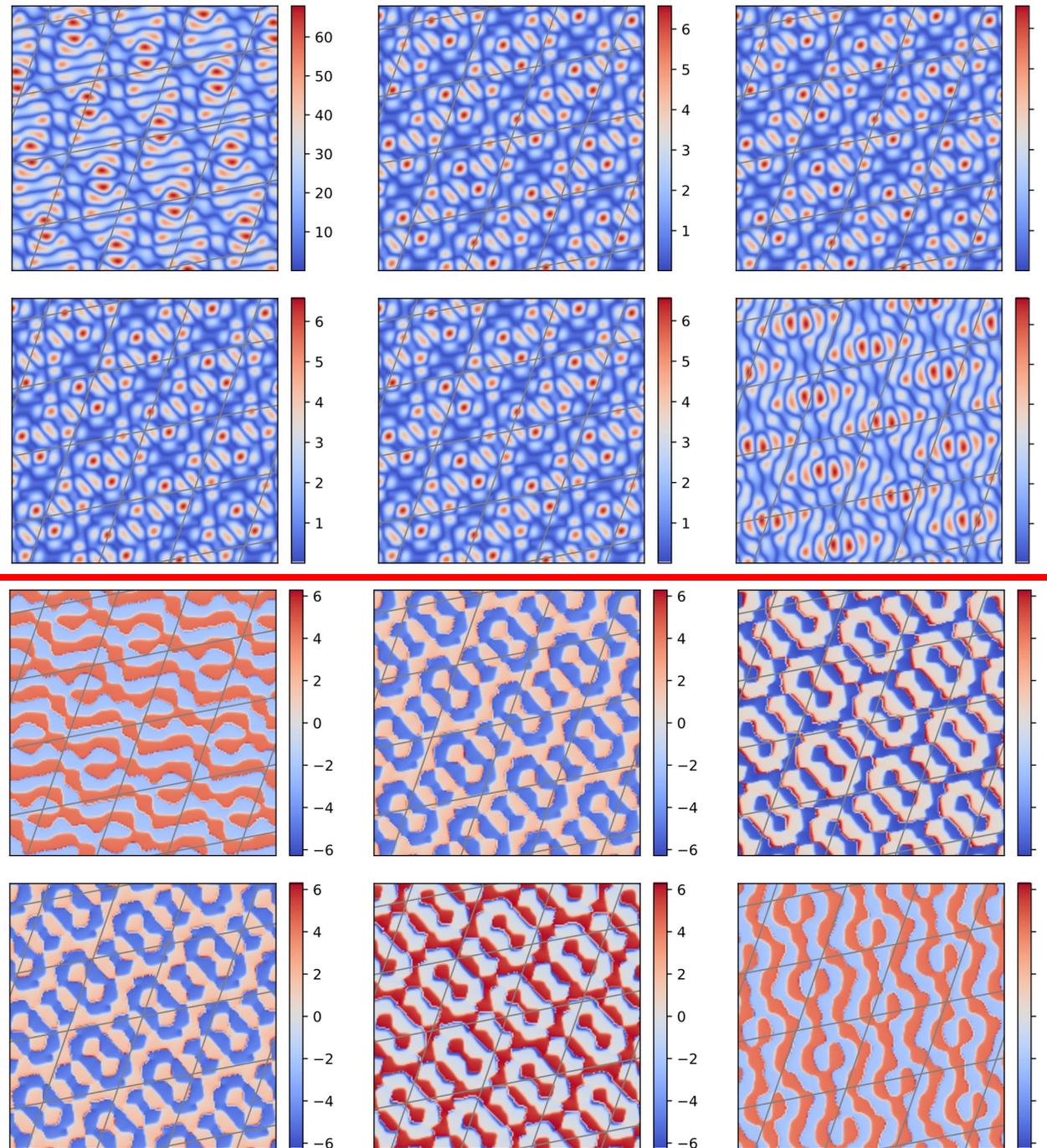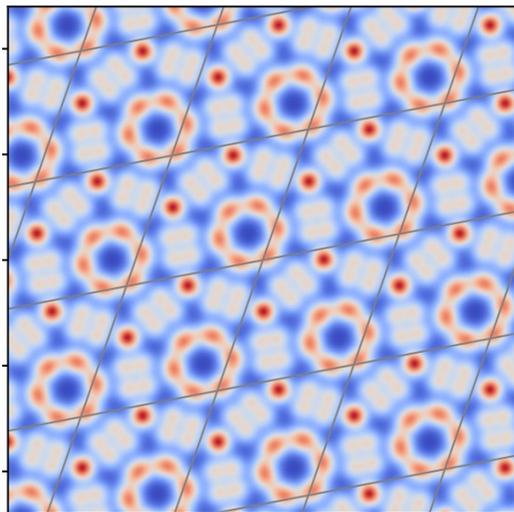
SE-Odd

- Amplitudes (top)

- Phases (bottom)

- All seem to be incommensurate
  - But periodic with period *more* than the moire unit cell

Existing Literature

- A. Yazdani, *et al* 2303.00024 – experiments (from the talk)
- A. Young, *et al* 2304.10586 – a similar experiment
- T. Stauber, *et al* 2308.01997 – Hartree-Fock order parameters

- B. Lian, *et al* 2305.19927 – Sqrt(3) x Sqrt(3) structures
- J. Cano, et al 2305.14423 – Sqrt(3) x Sqrt(3) structures

Yazdani's paper