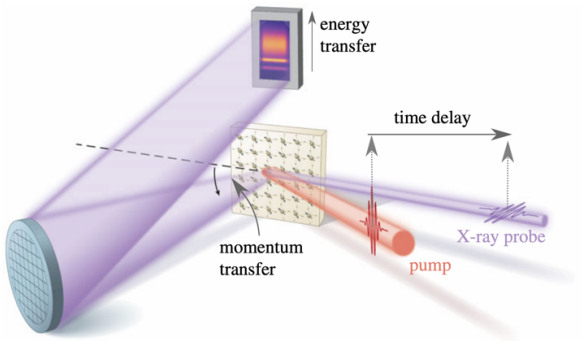
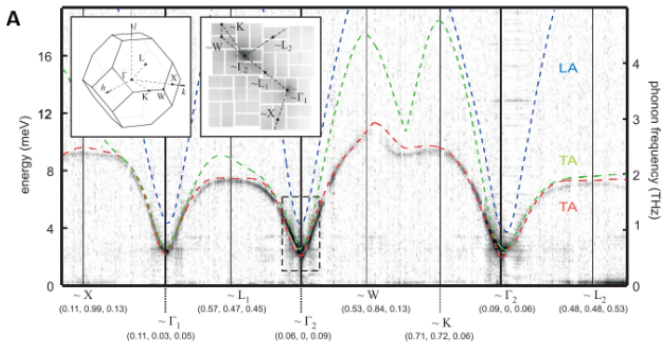
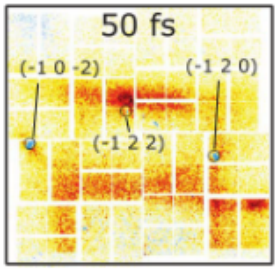
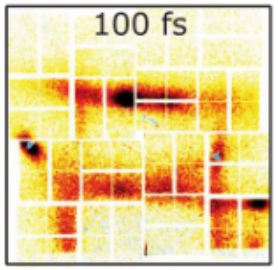
Science Opportunities in Quantum and Nanomaterials









Magnetic materials and control of ultrafast magnetisation

- Hard X-ray RIXS (Dean et al)
- Wide access to Q-space
- Pulsed magnetic field (50T/ms)
- Target excitation with THz
- Ultrafast de/magnetization

Structural dynamics and light induced phases in quantum materials

- VO_2 phonon dispersion (Wall et al)
- High rep-rate + weak excitation
- Avoids multiphonon states
- Target excitation with THz pump
- X-ray pump to improve overlap

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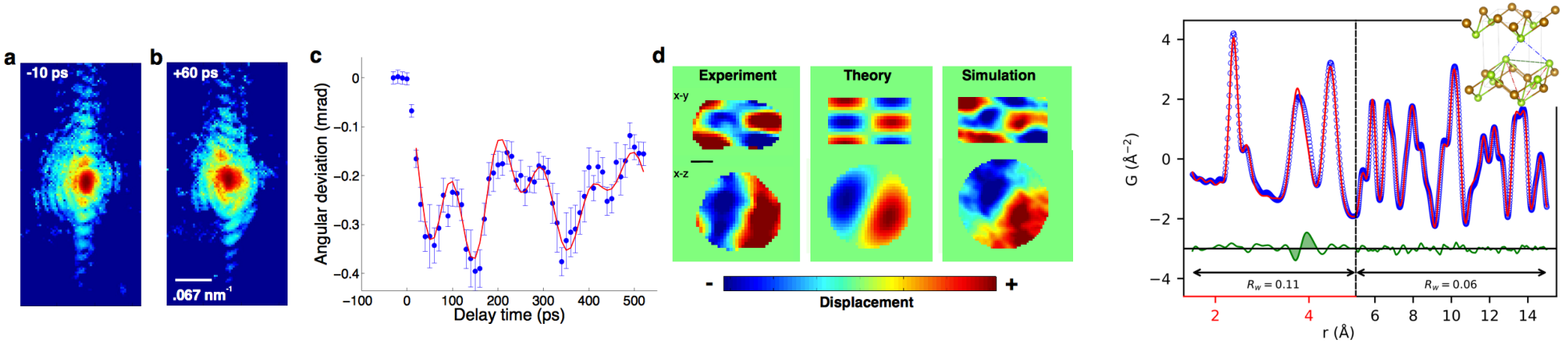


Imaging Dynamics in Nanomaterials

- Bragg coherent diffraction imaging
- Au NP breathing (Clark et al)
- Split/delay to see fast changes
- Ultrafast electronics for QIS

Time Resolved Pair Distribution Functions

- PDF of FeSe superconductor (Koch et al)
- Local changes far above phase trans
- Need high energy X-rays (50keV?)
- X-ray pump to improve overlap?

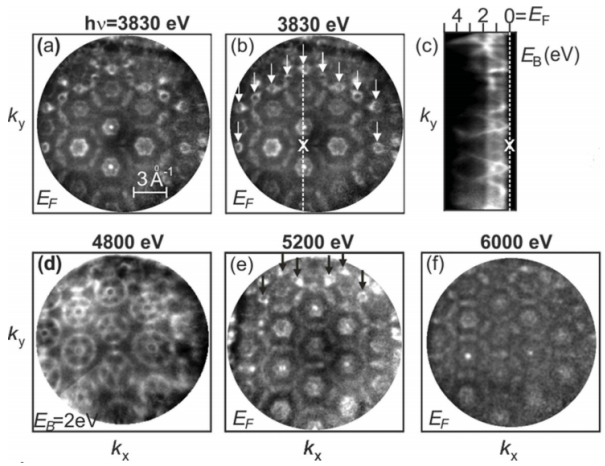
Science Opportunities in Quantum and Nanomaterials

Photon hungry experiments
Space charge challenge

Require unique X-ray capabilities: combination of high repetition rate, low energy pulses, transform limited narrow bandwidth, soft and hard X-ray energies (0.3 – 15 keV)

access to **electronically relevant time scales** will allow us to **probe electron dynamics in real time** delivering a full **dynamic picture** of the electronic behaviour

unprecedented insights into quantum materials for **electronic applications** enabling the conceptualisation and development of truly **novel device concepts**



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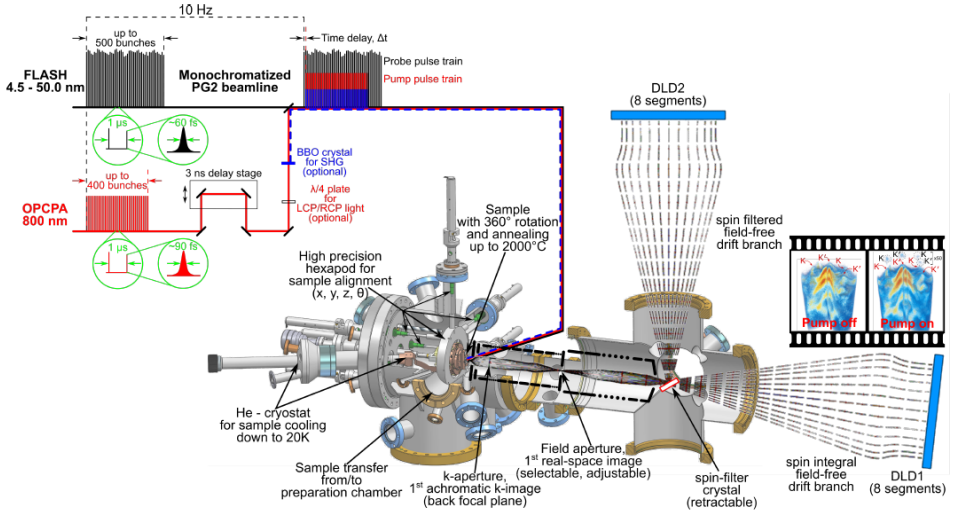

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