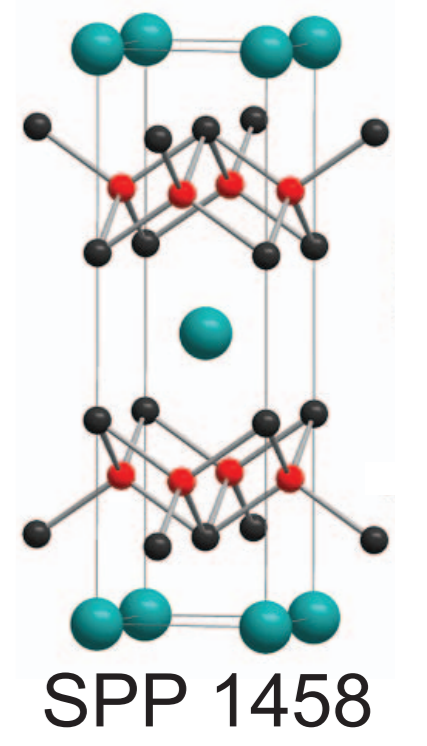


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KITP conference:
Strong Correlations and
Unconventional
Superconductivity
Santa Barbara, 09/2014

Introduction

- Interplay of magnetic and structural order
- Vicinity of magnetic order and superconductivity

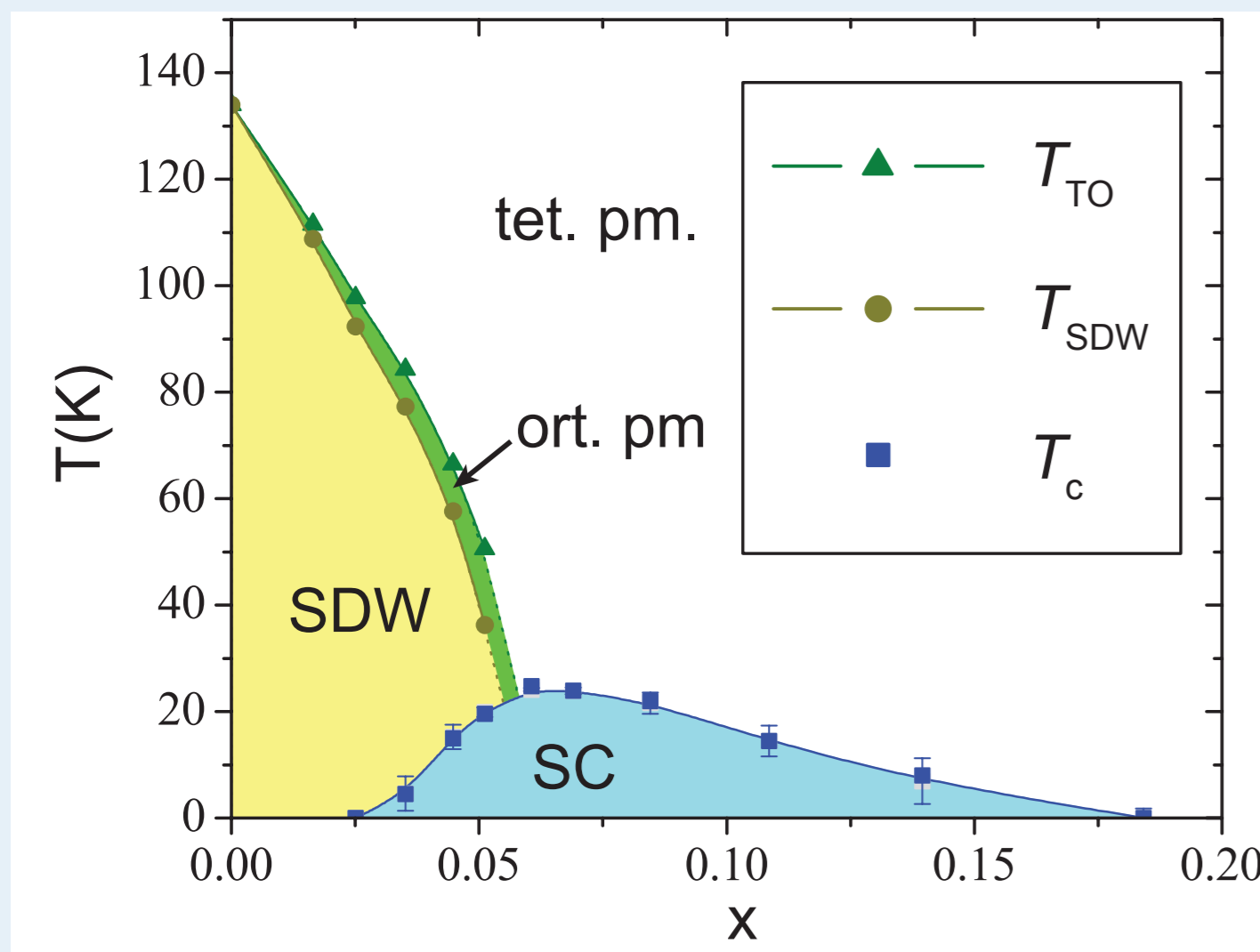


Figure: Chu *et al.*, Phys. Rev. B **79**, 014506 (2009)

- Open questions:
Origin of the magnetic order?
Driving force of the phase transition?

BaFe_2As_2

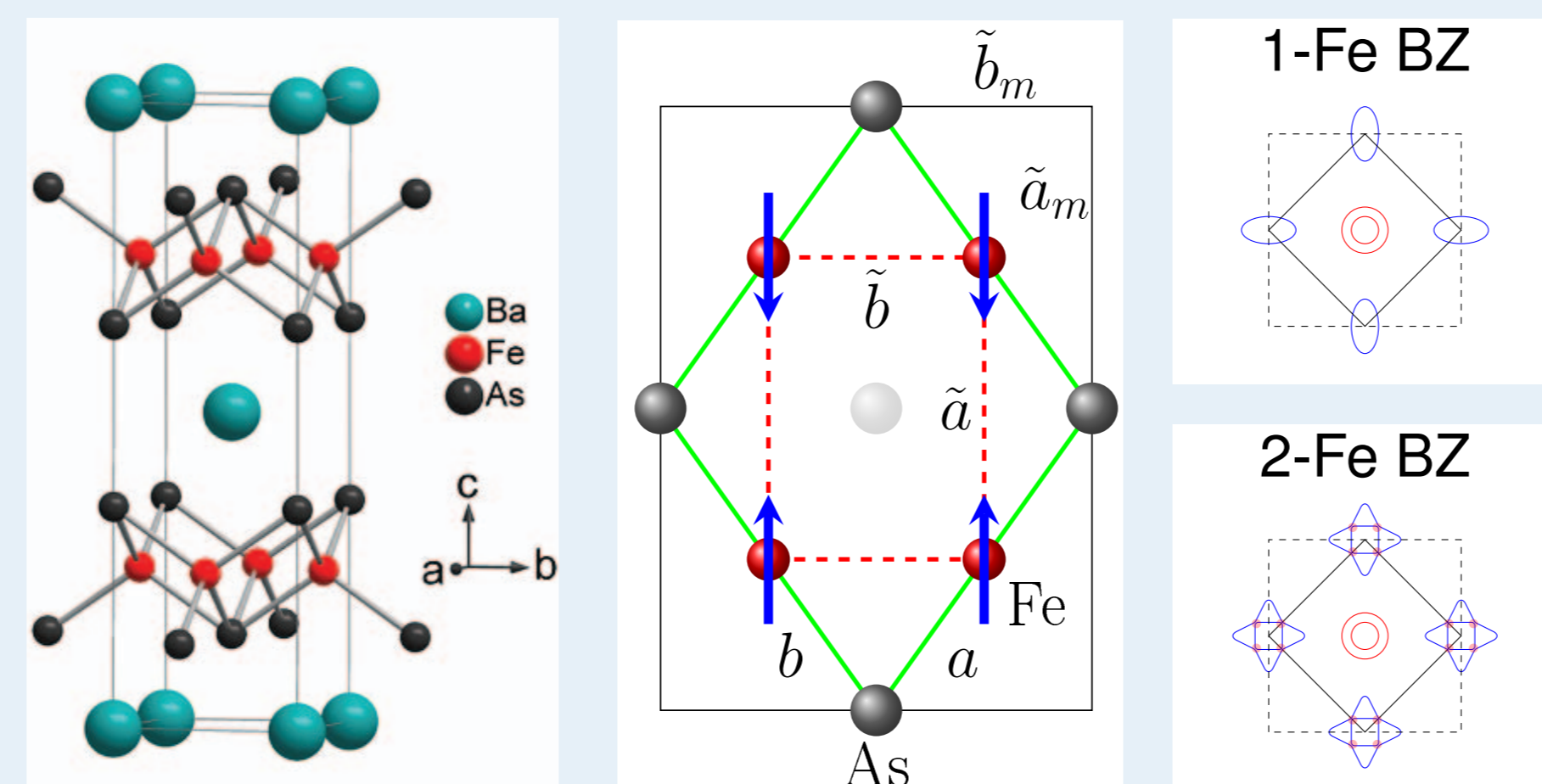


Figure: crystal structure
Rotter *et al.*, PRL **101**, 107006 (2008)

Figure: orthorhombic distortion

Figure: Brillouin Zone

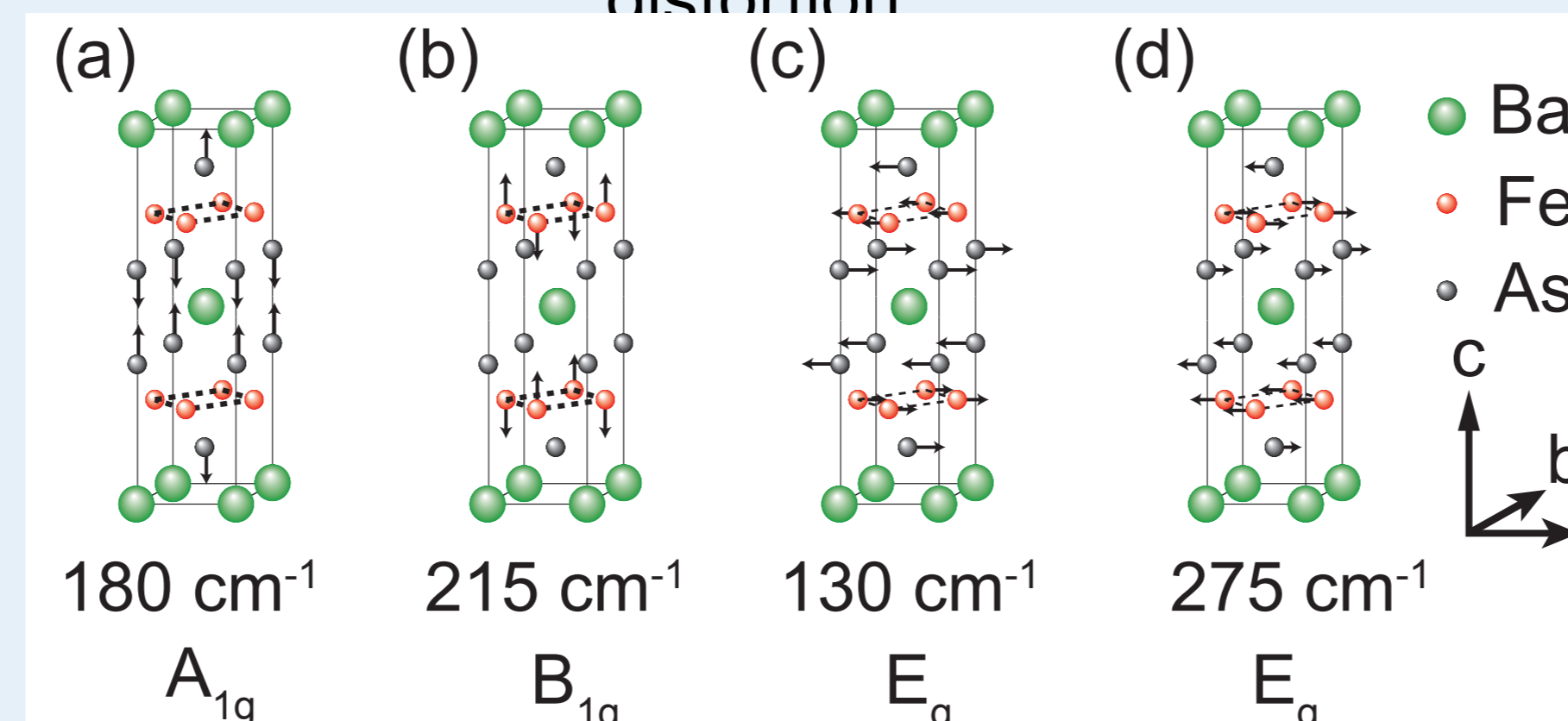


Figure: Raman active phonons in BaFe_2As_2

Anisotropy and detwinning

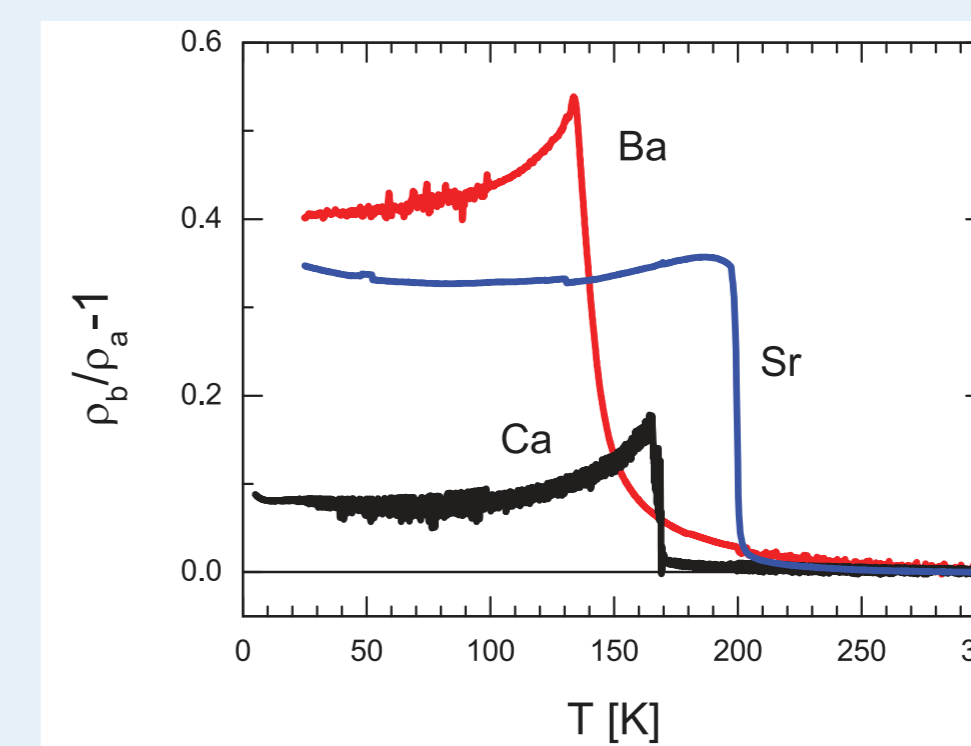


Figure: Anisotropy in transport properties
Blomberg *et al.*, PRB **83**, 134505 (2011)

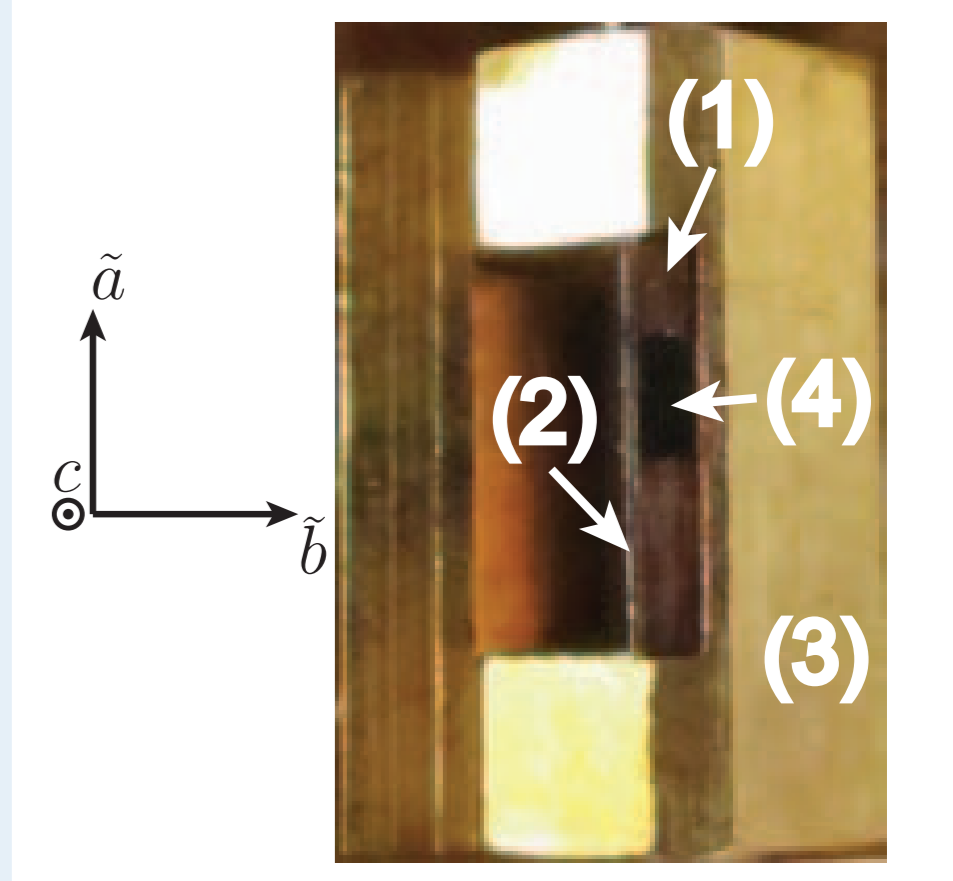
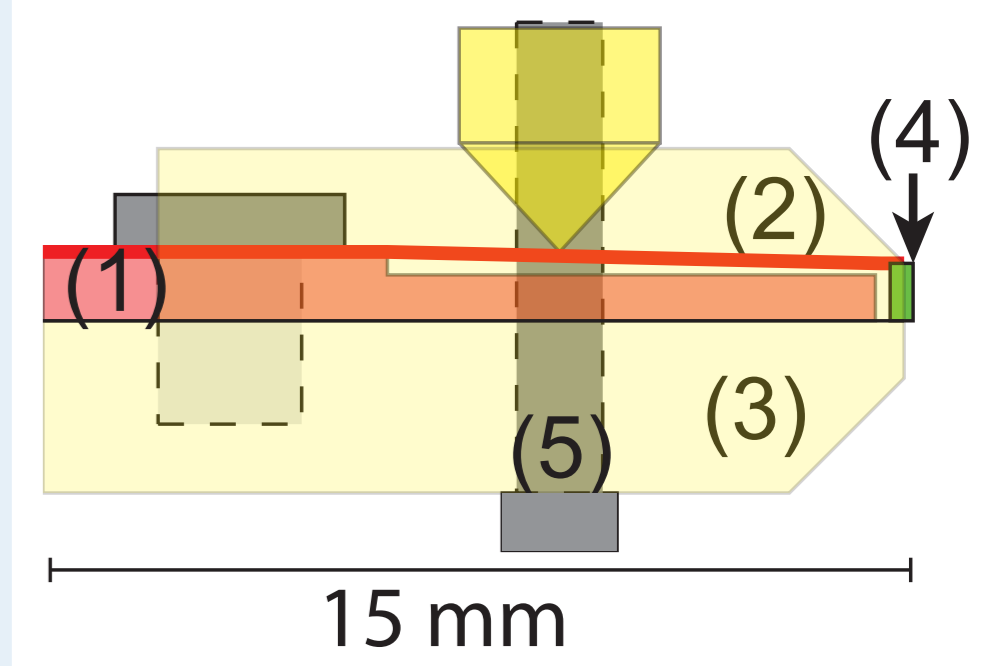


Figure: Detwinning by uniaxial pressure

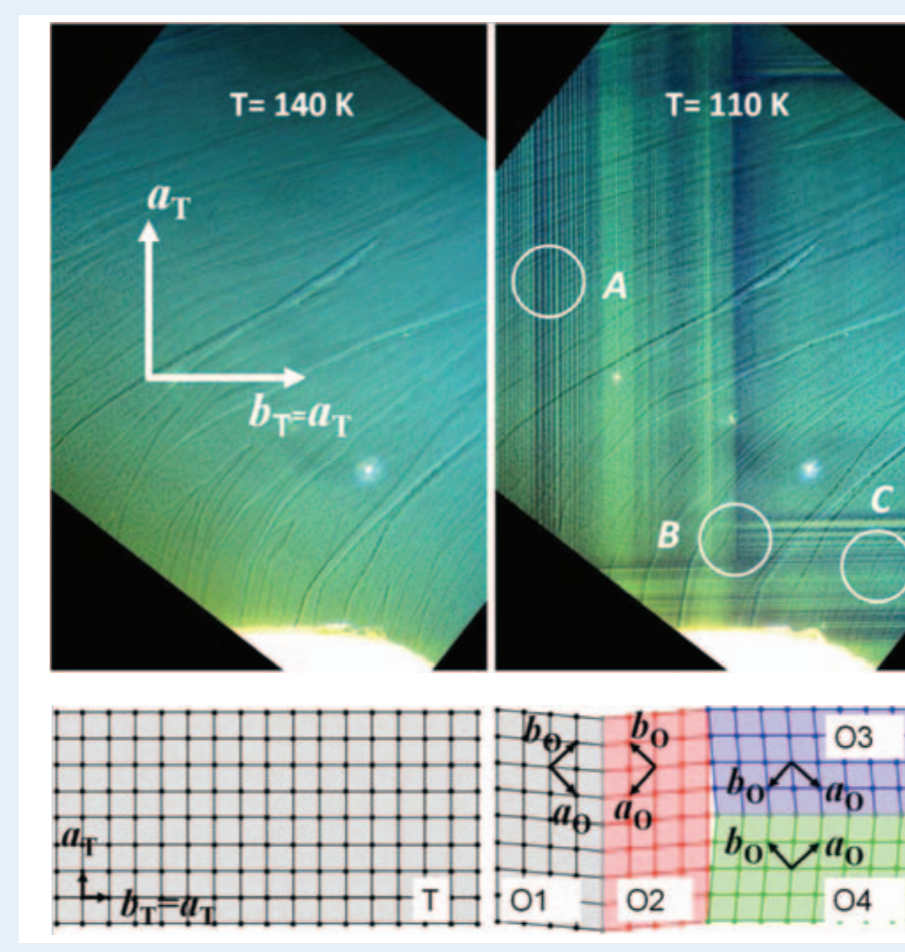
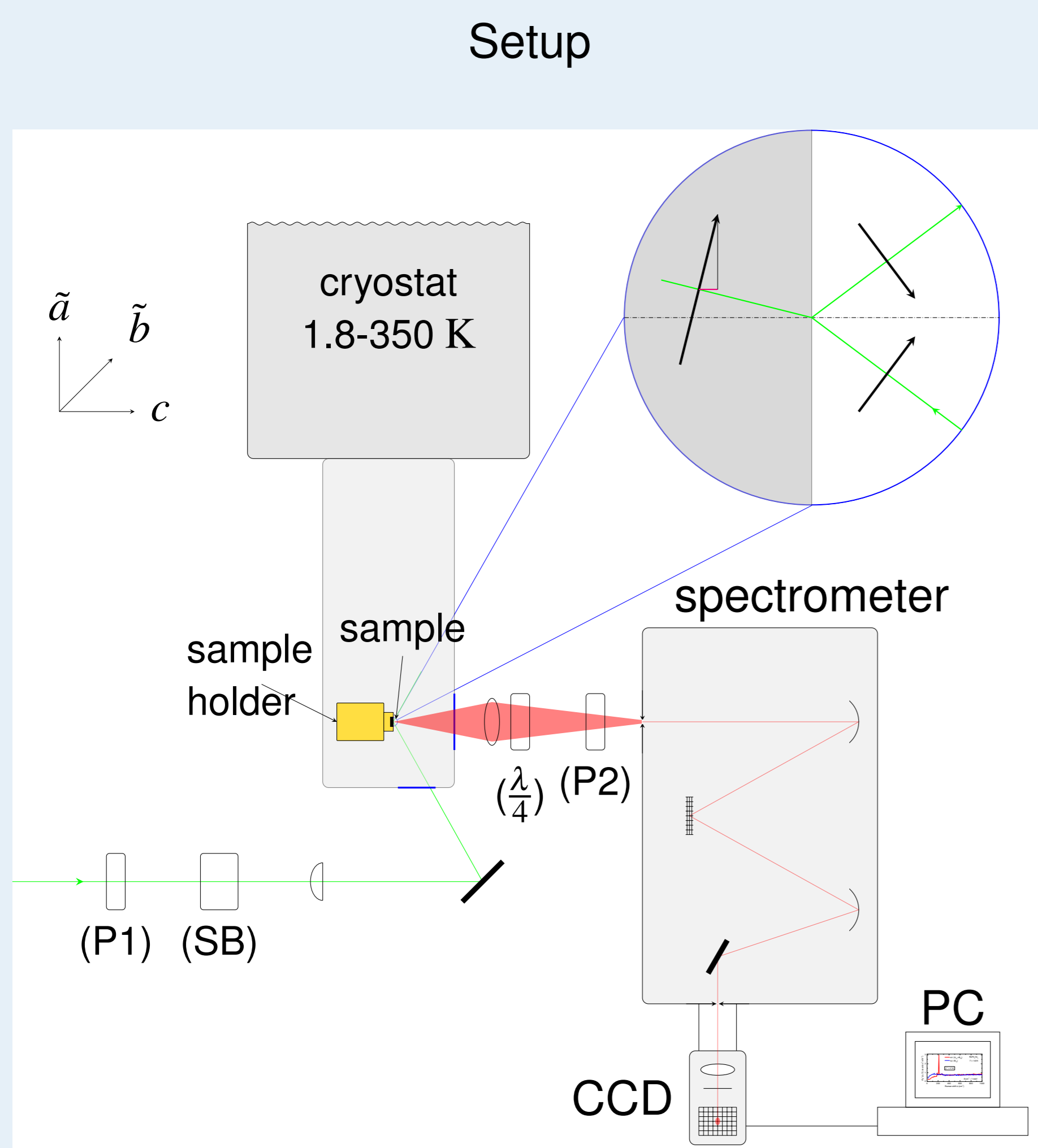


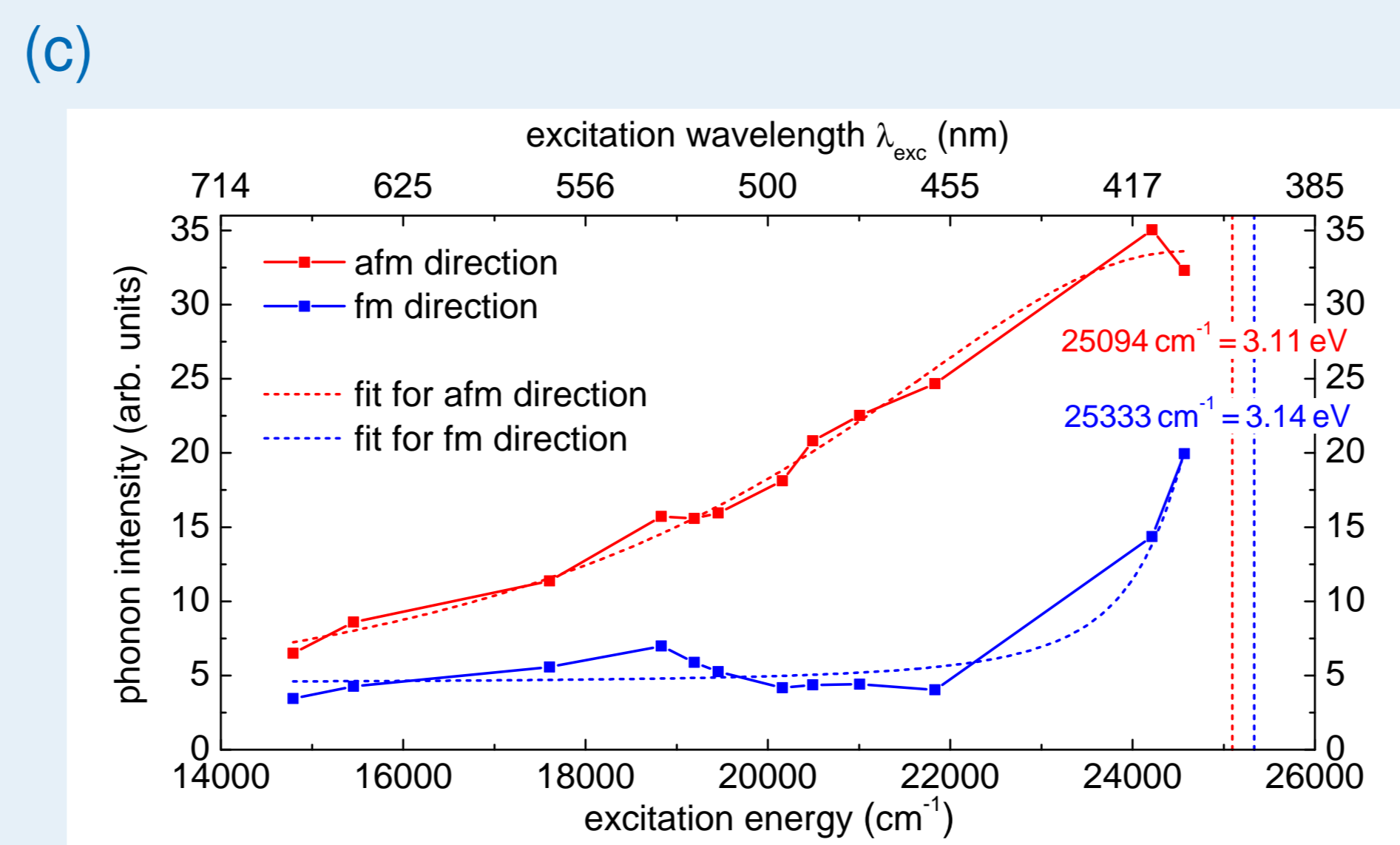
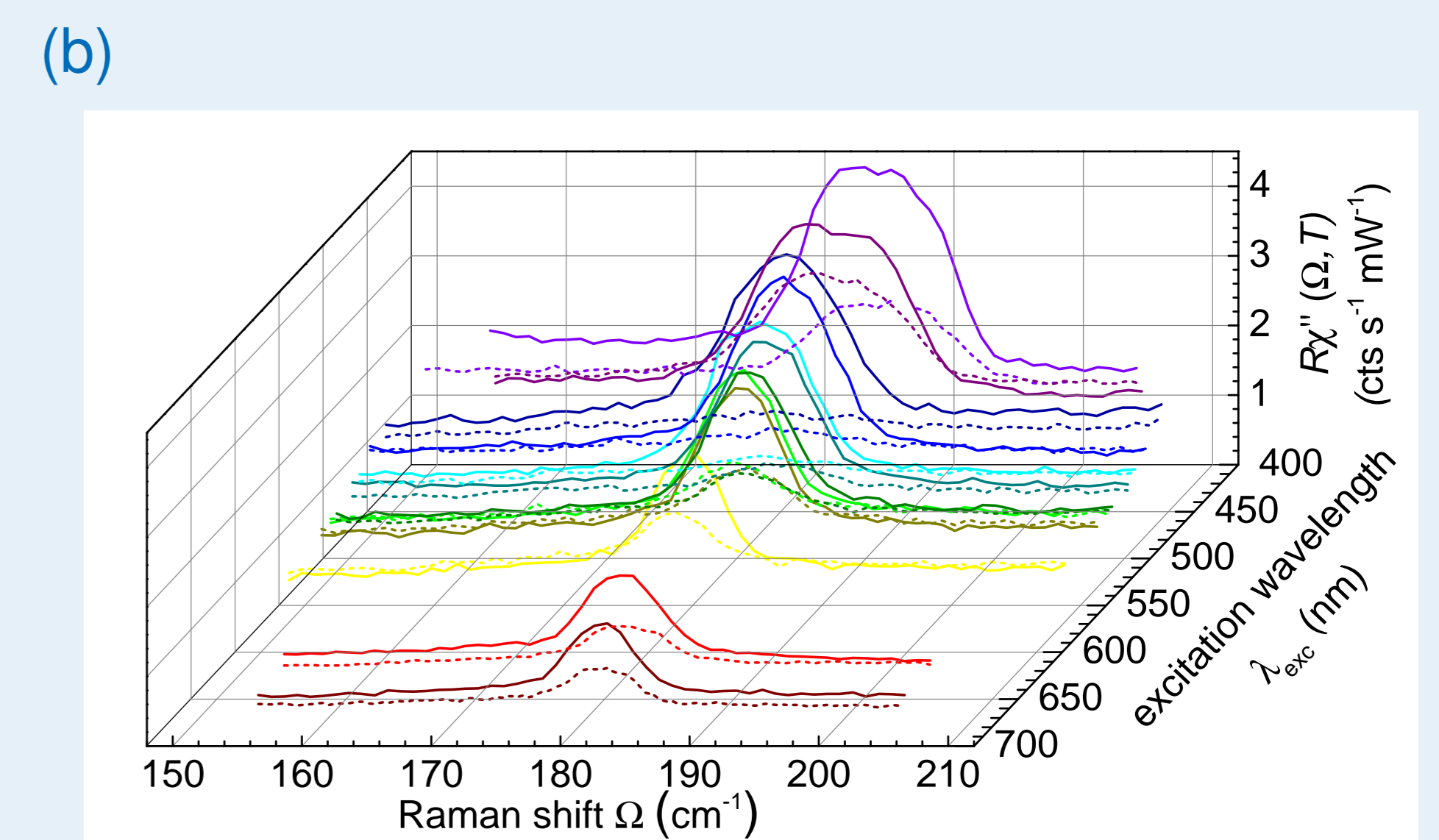
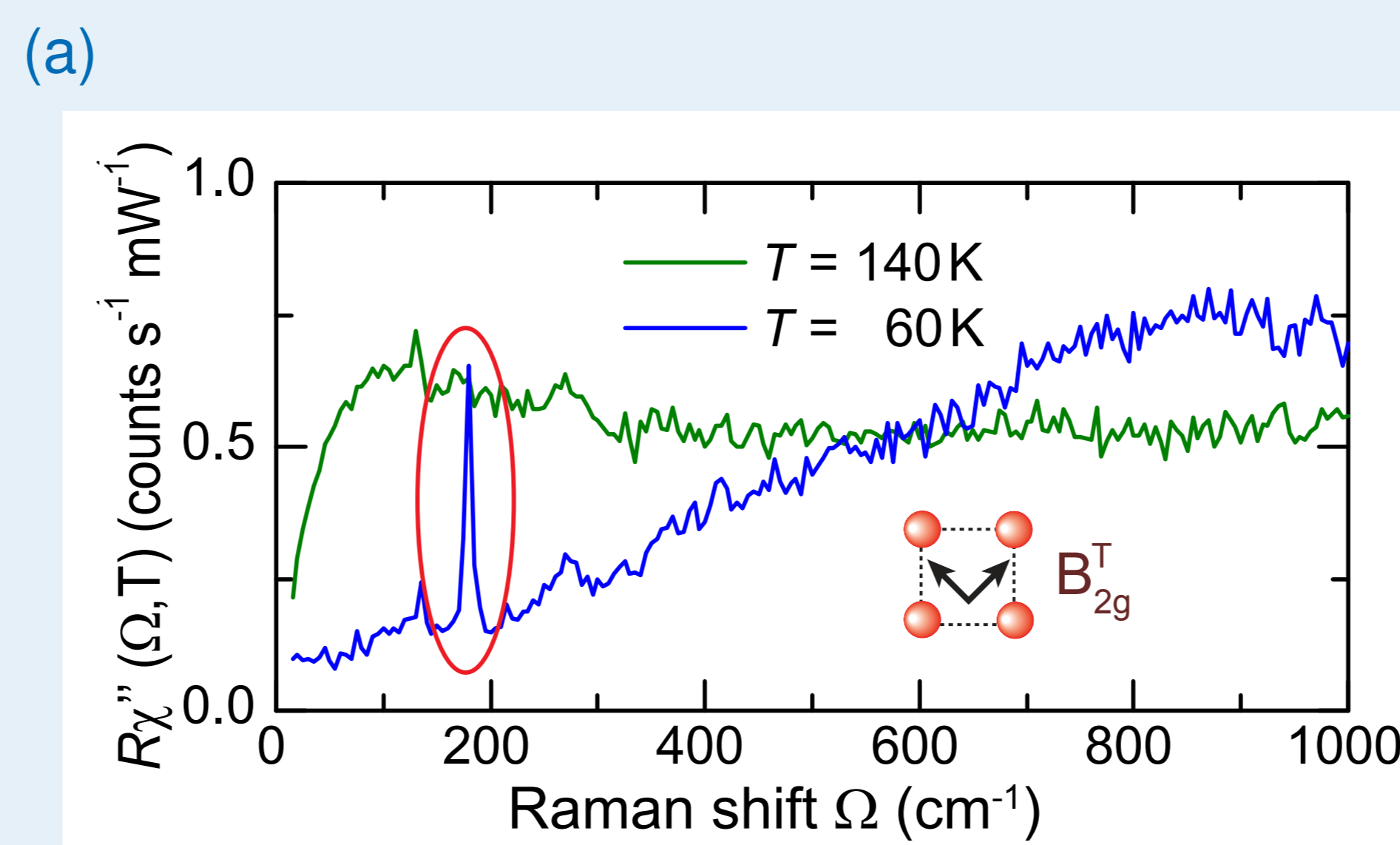
Figure: Twin domains in BaFe_2As_2
Tanatar *et al.*, PRB **79**, 180508 (2009)

Raman spectroscopy



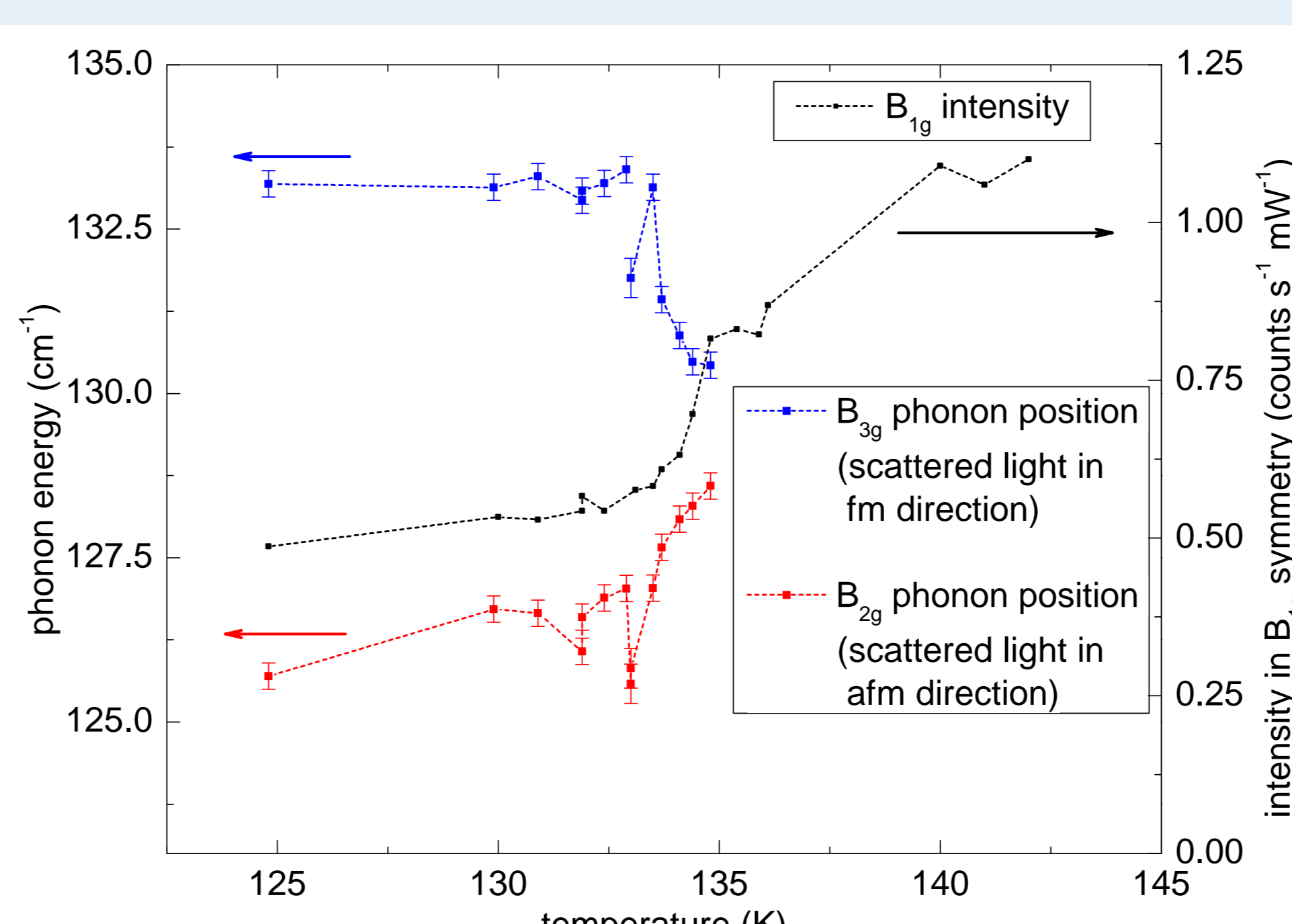
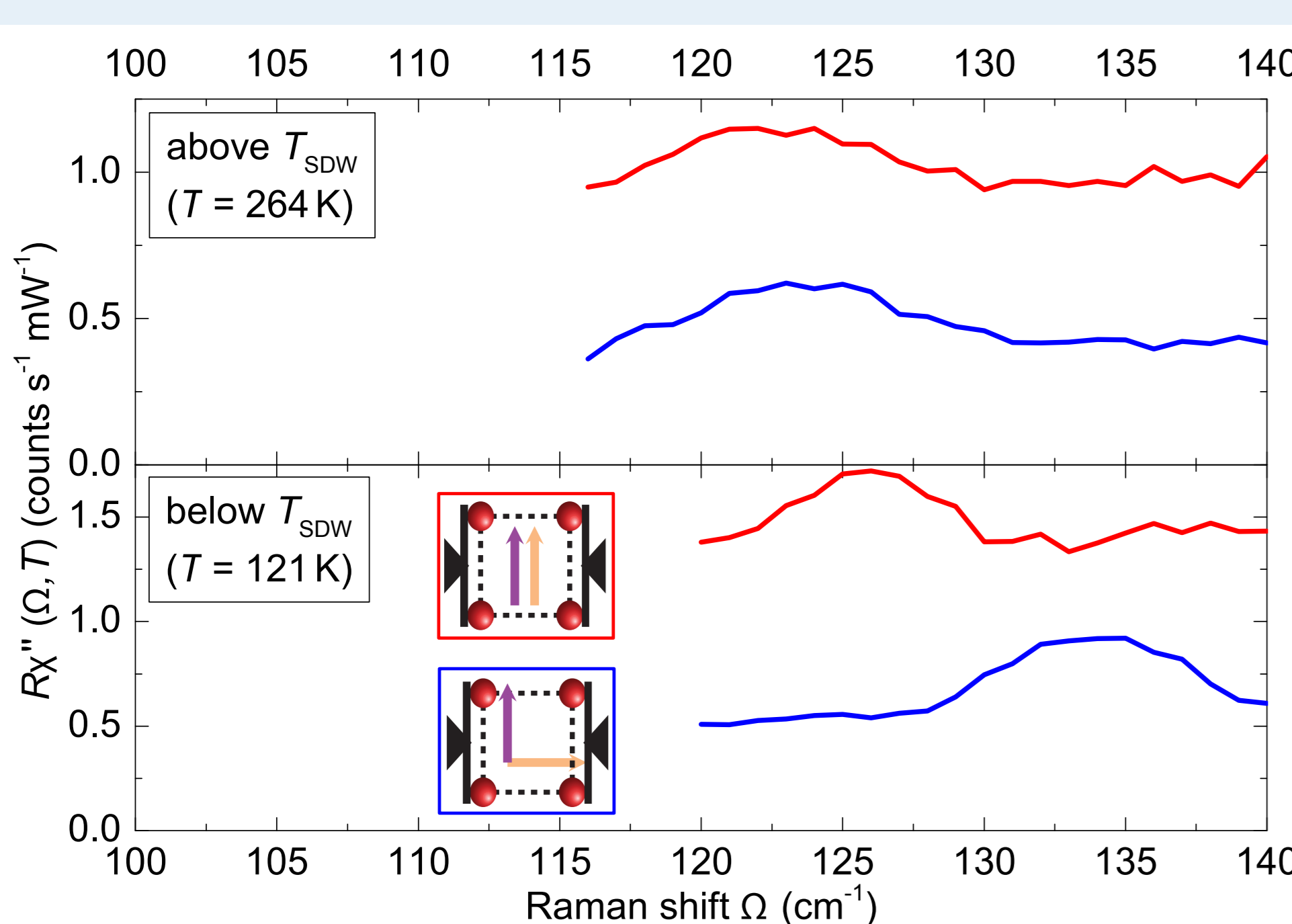
(P1),(P2) polarizers, (SB) Soleil-Babinet compensator, $(\lambda/4)$ quarter-wave plate

Anisotropy of the A_g phonon



- (a) Below the phase transition the A_g phonon appears in the tetragonal B_{2g} symmetry
- (b) In detwinned crystals the phonon intensity shows a significant anisotropy between the afm and fm direction.
- (c) The phonon intensity increases for shorter excitation wavelengths, showing a resonant behavior.

Splitting of the E_g phonon



Conclusion

- Uniaxial pressure can detwin the BaFe_2As_2 crystals, facilitating access to anisotropic features
- The A_g phonon shows a resonance at approximately 3.1 eV for polarizations along the afm and fm direction.
- The widths of this resonance differ significantly for the afm and fm direction, indicating a strong influence of the band reconstruction along the afm ordered axis
- The E_g phonon at 125 cm^{-1} splits into a B_{2g} (afm) and B_{3g} (fm) mode at the magnetic phase transition