

2019 PARADIM SUMMER SCHOOL ON MBE + ARPES

Lab introduction

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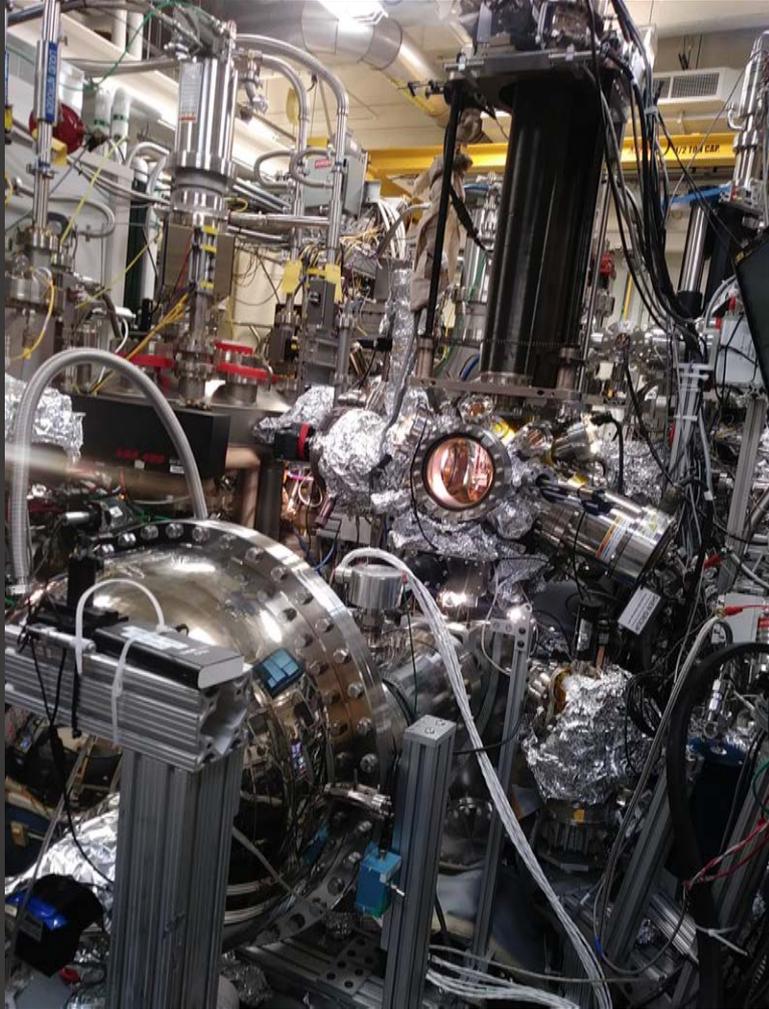
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Engineering**



PARADIM
AN NSF MATERIALS INNOVATION PLATFORM

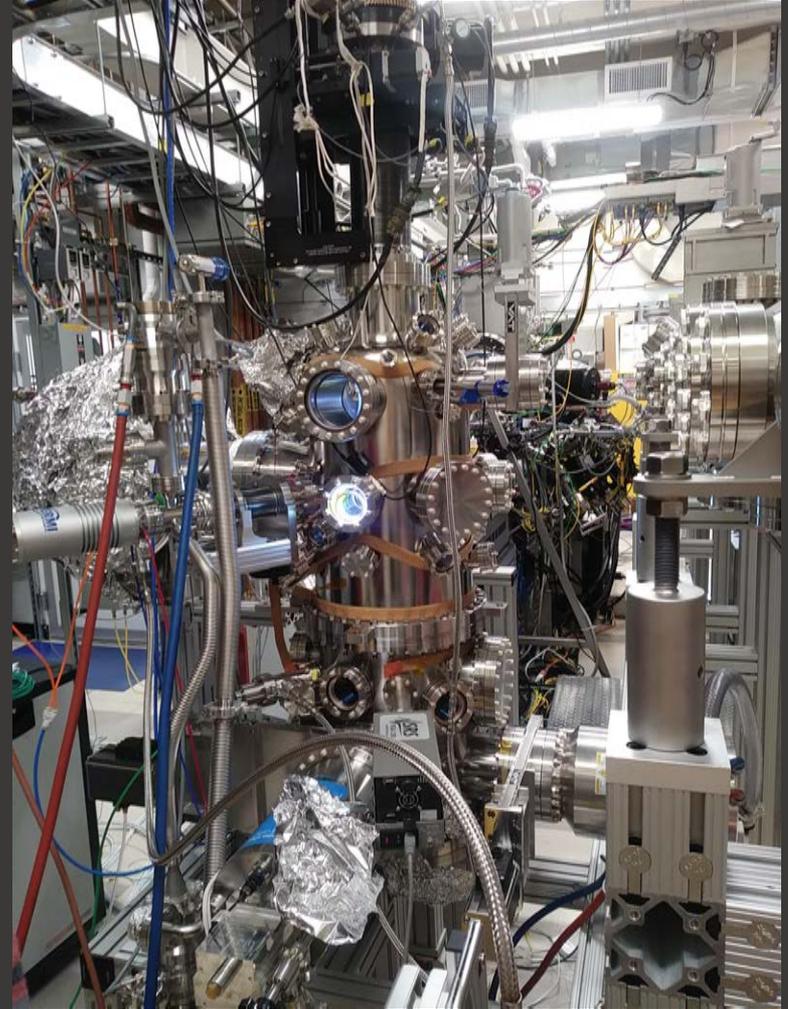
Two setups

308



He lamp (21.2 eV, 40.8 eV, ...)
+ monochromator

312 - PARADIM

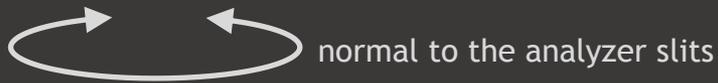
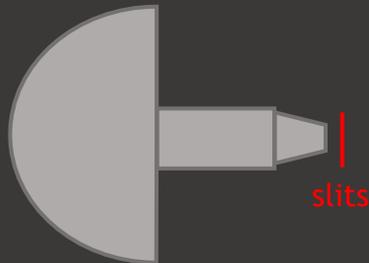
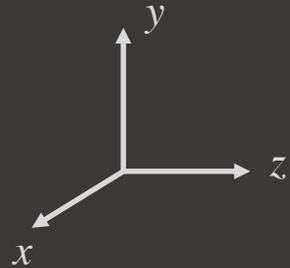


Multi-gas lamp, now Kr (10 eV, 12.8 eV,...)
+ filter

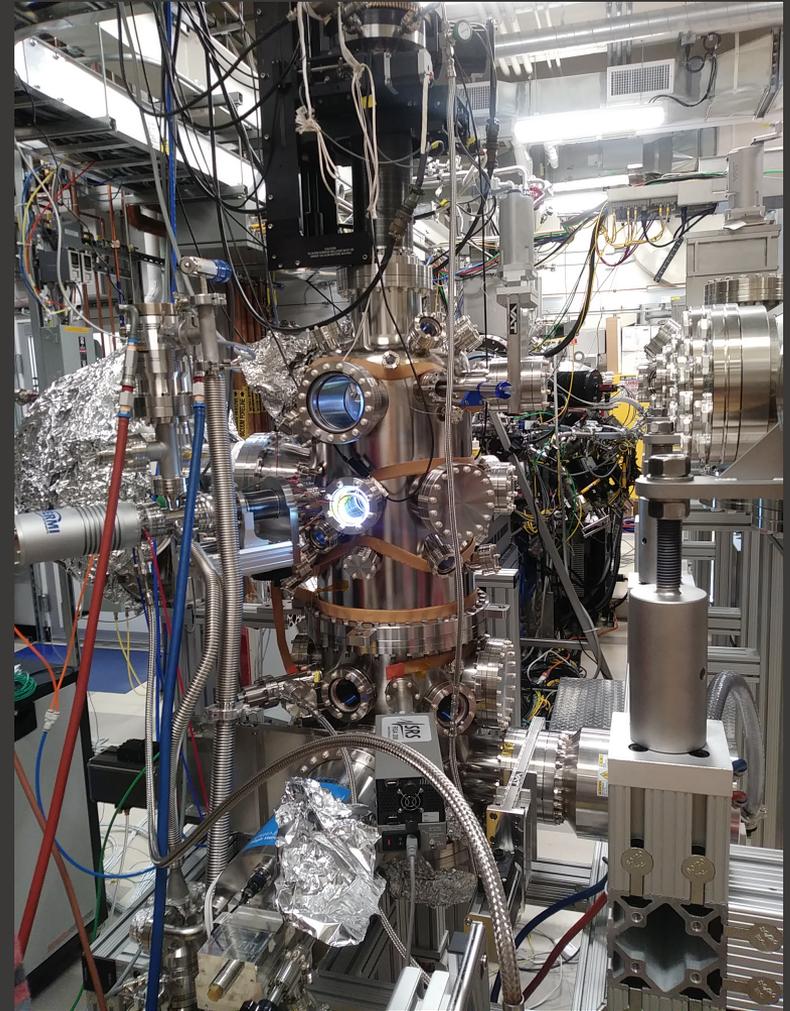
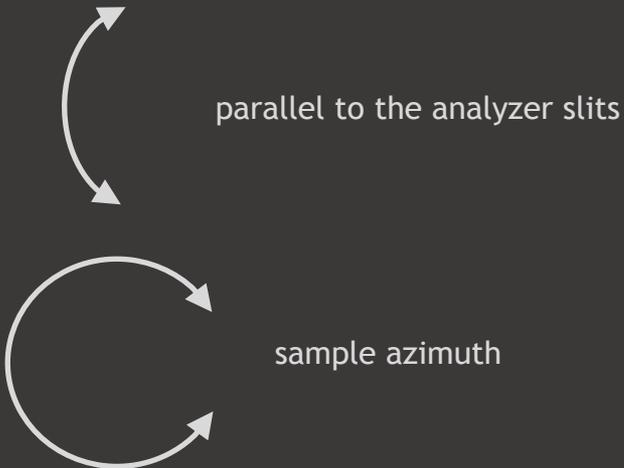
Two setups

312 - PARADIM

The six axes of motion

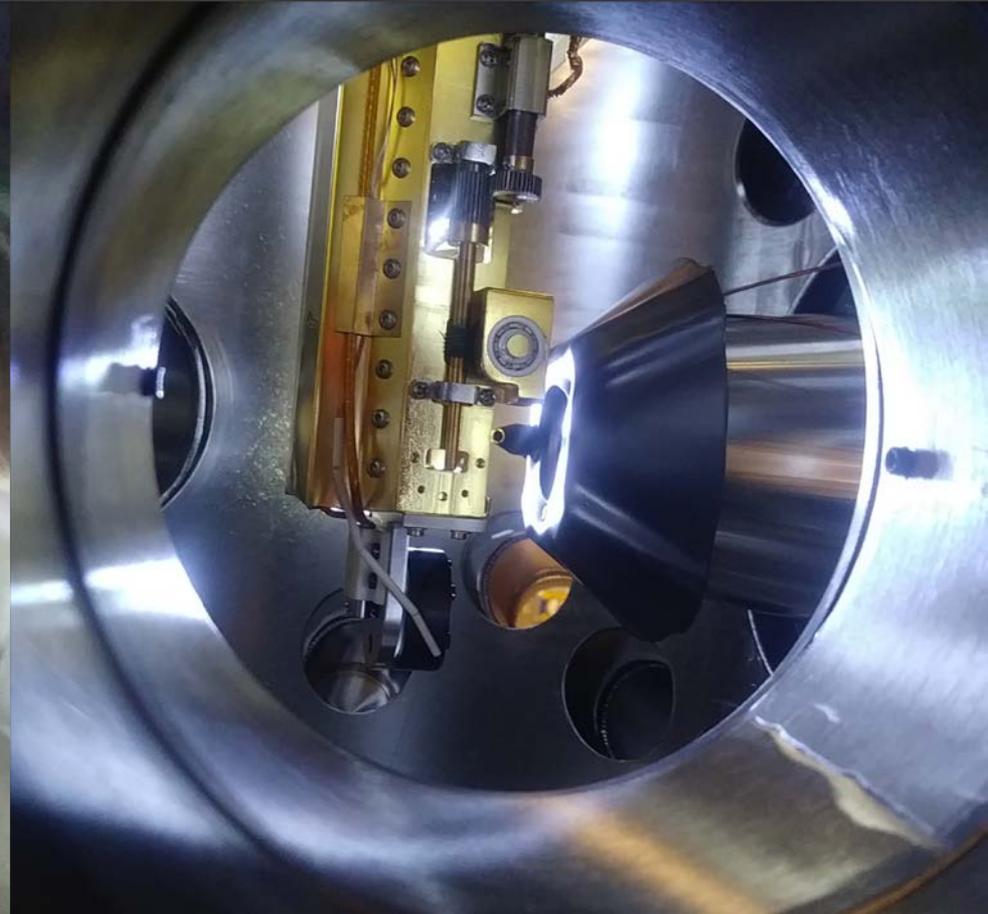


internal motions



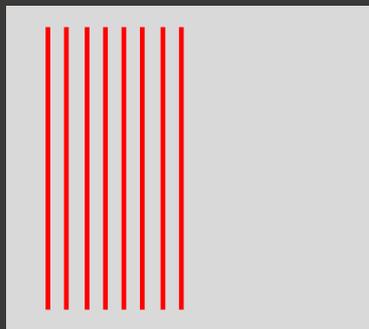
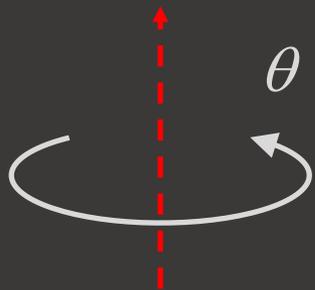
Multi-gas lamp, now Kr (10 eV, 12.8 eV,...)
+ filter

A close up of the sample stage

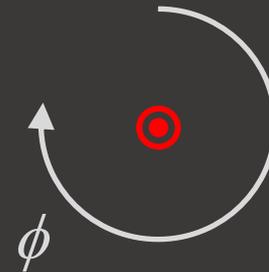
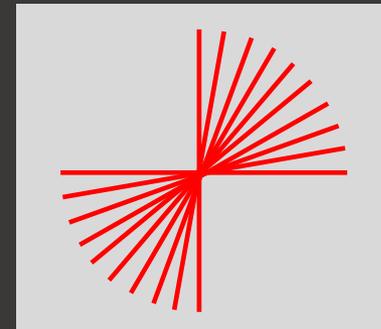
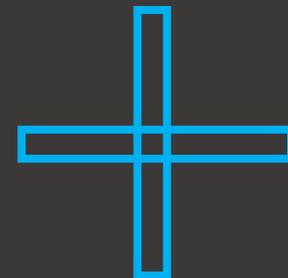
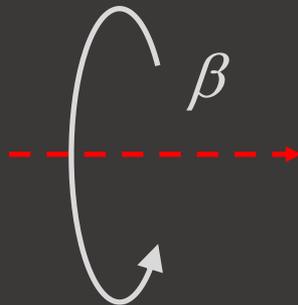
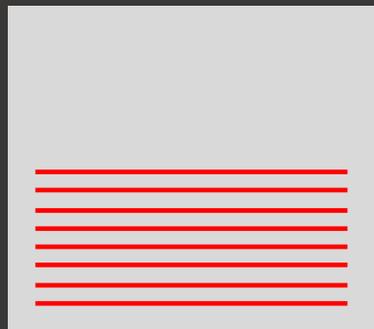


Typical measurement geometries

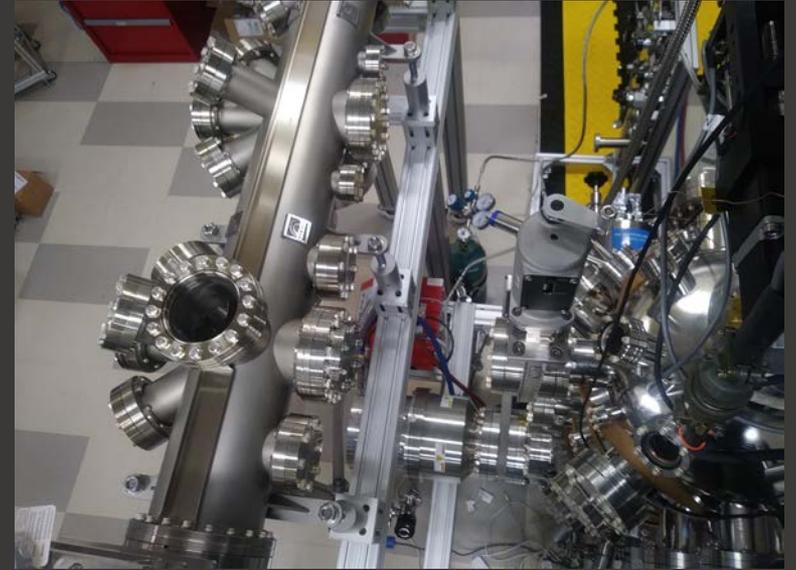
main rotation axis



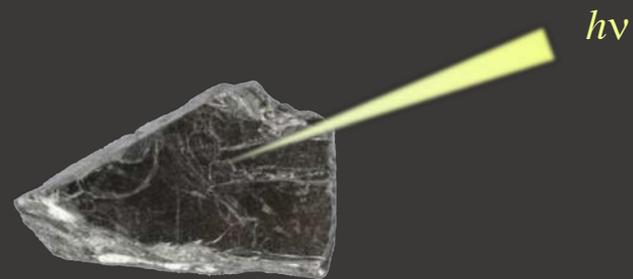
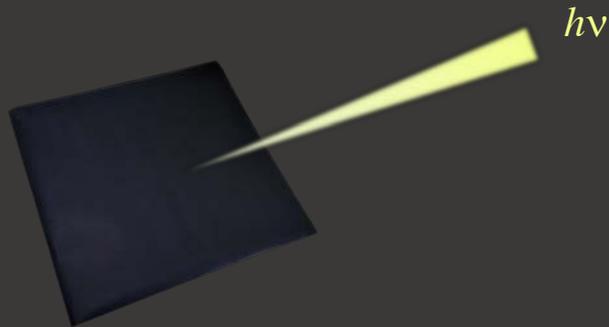
analyzer slits



Human connection is important, and so is vacuum connection



Measuring films vs measuring single crystals



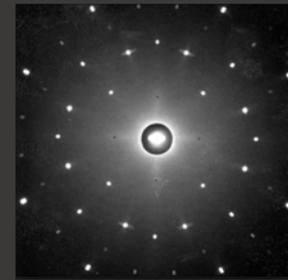
+ easily aligned

+ beam spot size essentially irrelevant (if homogeneous)

- typically needs *in situ* growth

- the film IS your surface, has to be kept clean from growth to measurement

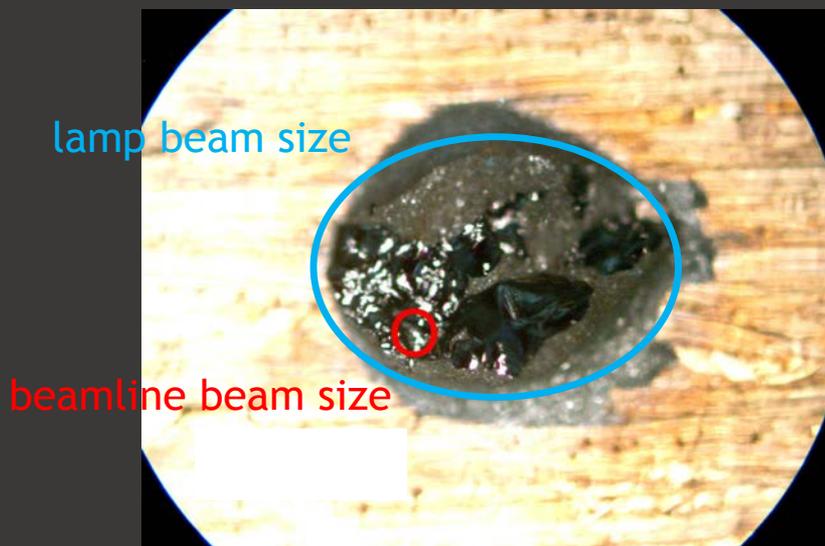
- typically no obvious axis for aligning (not so long ago: Laue)



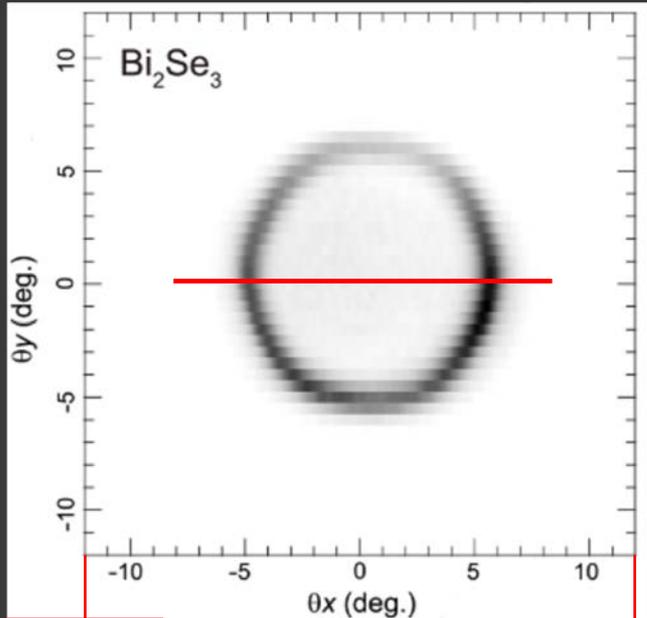
- beam spot size can determine success/failure of the experiment

+ the surface to measure is preserved until it's cleaved/fractured

Single crystal mounting



Bi₂Se₃ in a snapshot



-0.185

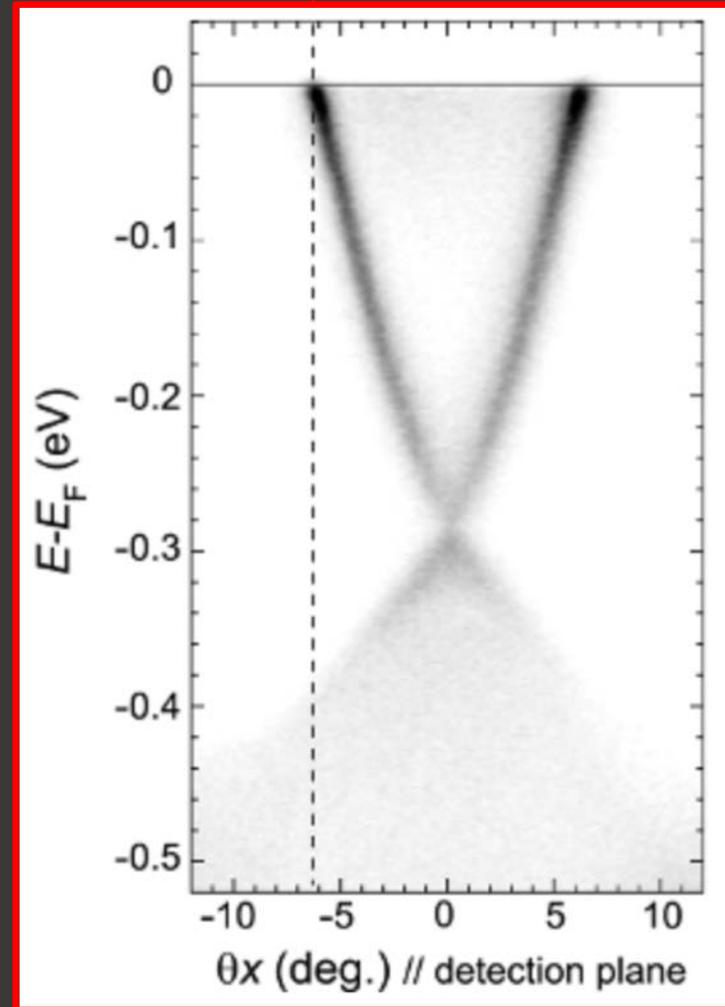
0.185

$$E = \frac{p^2}{2m} = \frac{\hbar^2 k^2}{2m} \Rightarrow k_{\parallel} = \frac{\sqrt{2mE}}{\hbar} \sin(\theta)$$

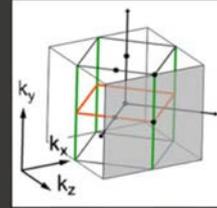
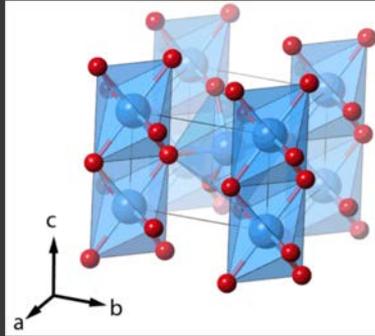
$$\Rightarrow k_{\parallel} [\text{\AA}^{-1}] = 0.5124 \sqrt{E [\text{eV}]} * \sin(\theta)$$

measured with 7 eV laser

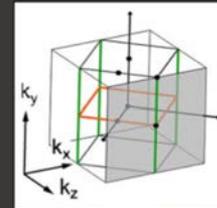
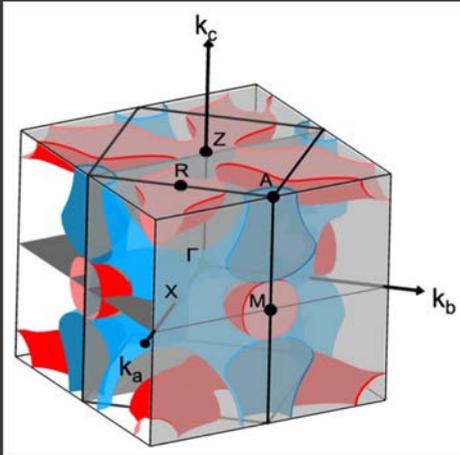
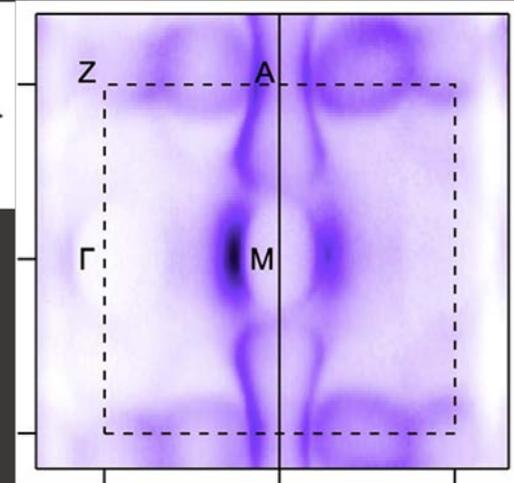
$$k_F \cong 0.1 \text{\AA}^{-1}$$



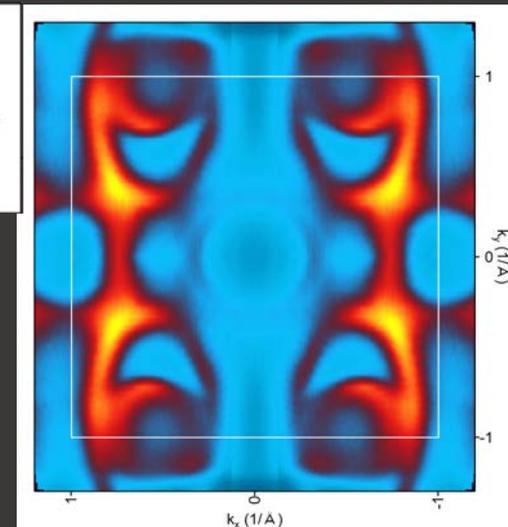
IrO₂ in a snapshot



measured at 84 eV
(synchrotron beamline)



measured at 21.2 eV
(He lamp)



NbSe₃ in a snapshot

