

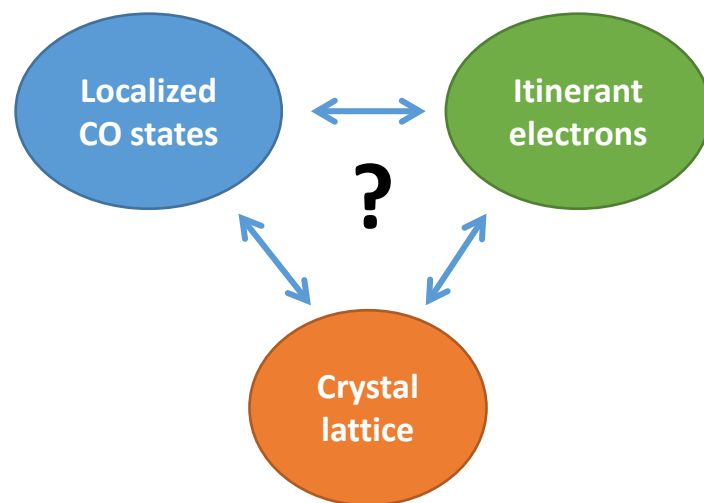
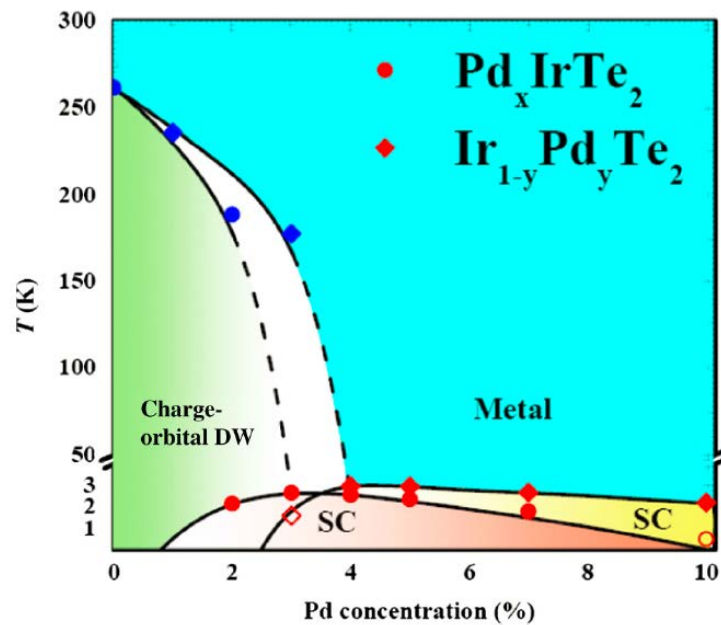
Exploring Charge Order Formation in IrTe₂

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19th ATF Users' Meeting

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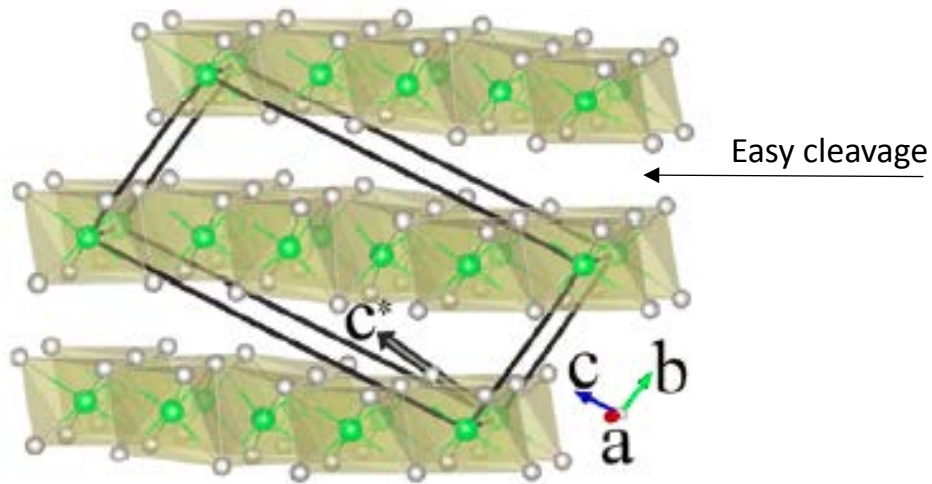
IrTe₂: cooperative electron states



J.J. Yang et al, PRL 108, 116402 (2012)

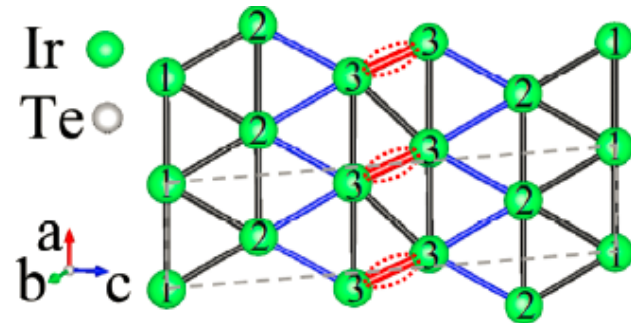
IrTe₂: crystal structure

Layered structure

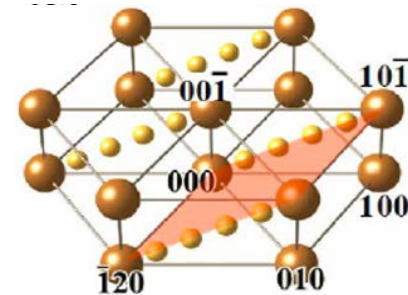


G.L Pascut PRL 112, 086402 (2014)

Dimers formation



Superlattice modulation



J.J. Yang et al, PRL 108, 116402 (2012)

IrTe₂: phase transition

	CDW	IrTe ₂
Rise if electrical resistivity (low T)	+	+
nesting vector	+	+
competing with SC	+	+
CDW gap	+	-
sinusoidal modulation	+	-
drastic increase in TC with doping or pressure	-	+
Modulation vector/domains	Single domain 3 vectors	3 types of domains, single vector

Possible explanation of phase transition:

- Charge/orbital ordering
- Crystal field effect
- Ir chain formation
- Depolymerization of interlayer Te bonds

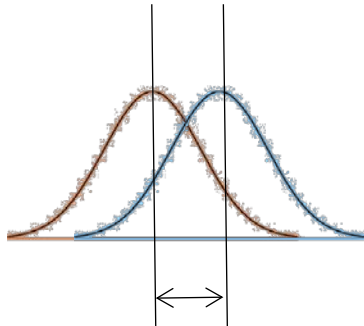
Is CDW formation the reason for 280K phase transition?

Measurement of lattice changes with diffraction experiments

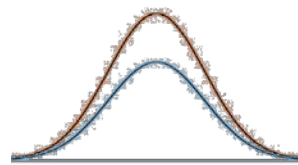
Structure factor:

$$SF(q; T, r_1, \dots, r_N) = \sum_{\mu=1}^N f_{at}^{\mu} e^{-B^{\mu}(T)q^2} e^{iqr_{\mu}}$$

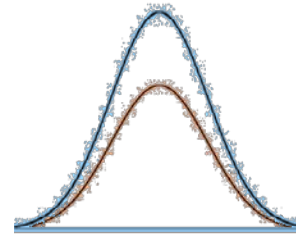
$$\text{D-W factor } B^{\mu}(T) = -\frac{\langle x_t^{\mu 2} \rangle}{3}$$



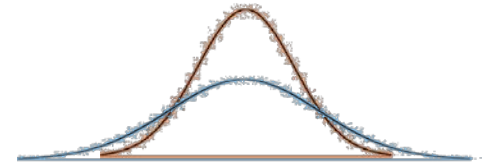
displacement:
unit cell parameters change



intensity drop:
phonons, static
atomic
displacements



intensity increase:
ordering of atoms

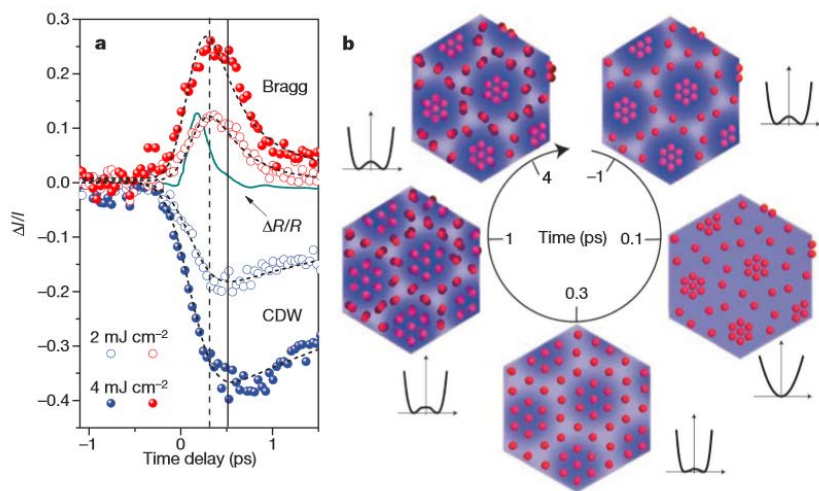


peak broadening:
increase of disorder,
macroscopic sample
deformation

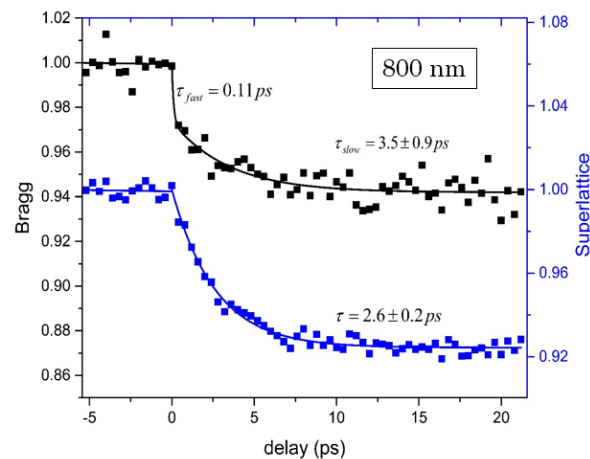
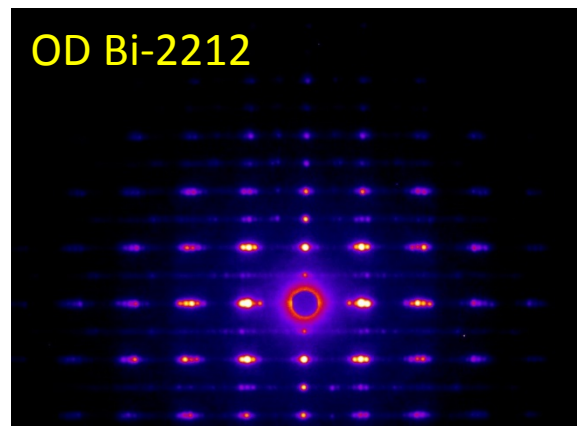
UED study: strongly correlated electrons systems

Cuprate high-T_c SC el-lattice interaction

CDW dynamics in 1T-TaS₂



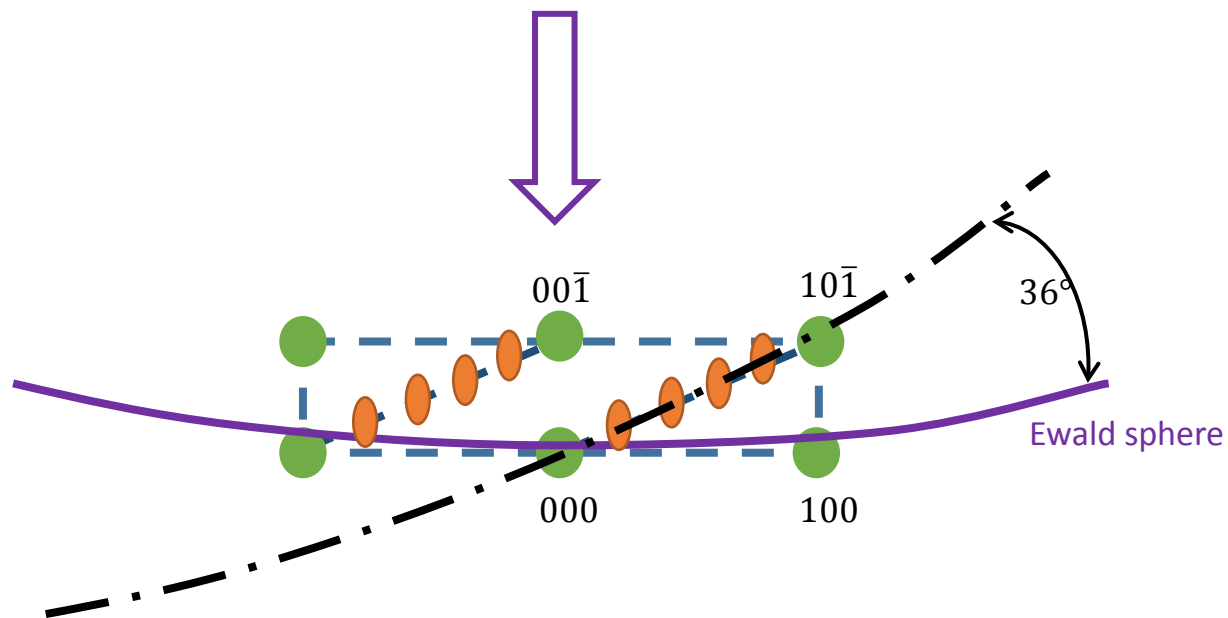
Eichberger. M. et al 2010 Nature 468 799–802



UED study of IrTe₂: experimental plan

1. Pump-probe experiment across 280 K structural phase transition:
 - superlattice order melting (compare to CDW materials)
 - Depolymerization
 - Lattice deformation
2. Pump-probe experiment at normal state:
 - Debye-Waller effect (compare to transitional changes)

UED study of IrTe_2 : possible difficulties



To observe SL peaks sample need to be tilt by 36°

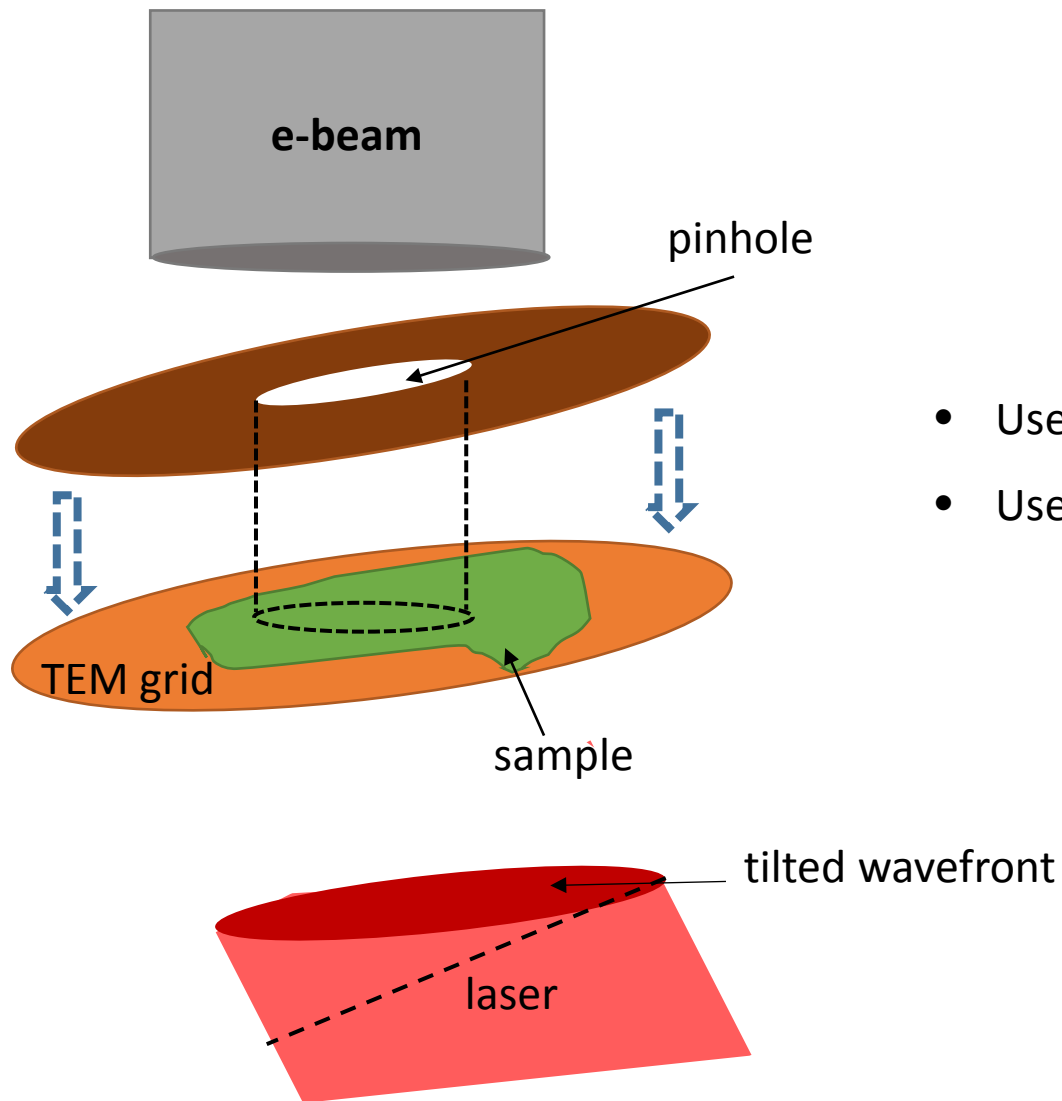


- Increase of the effective pulse duration
- Increase of the effective sample thickness



- Temporal resolution gets worse
- Signal to noise ratio drops
- Possible asymmetry in diffraction pattern

UED study of IrTe₂: possible difficulties solutions



Conclusion:

- Time-resolved UED measurement of IrTe₂ lattice response to photo-excitation will give a hierarchy of processes involved in the second order 280K phase transition
- Understanding of charge ordering in IrTe₂ will broaden the knowledge about mechanisms of interaction of localized and itinerant electrons in systems capable of superconducting state