

Time-resolved Diffuse X-ray Scattering

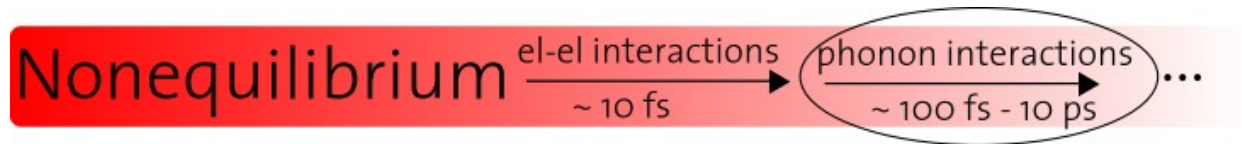
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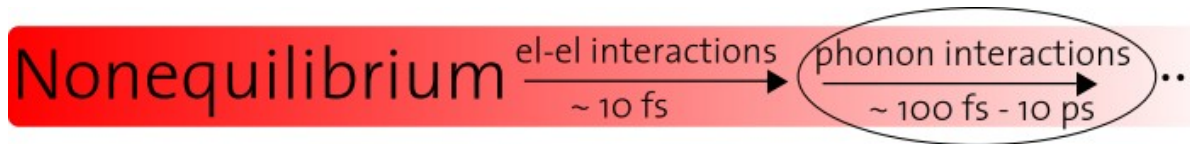
Motivation

Relaxation of hot carriers in condensed matter:

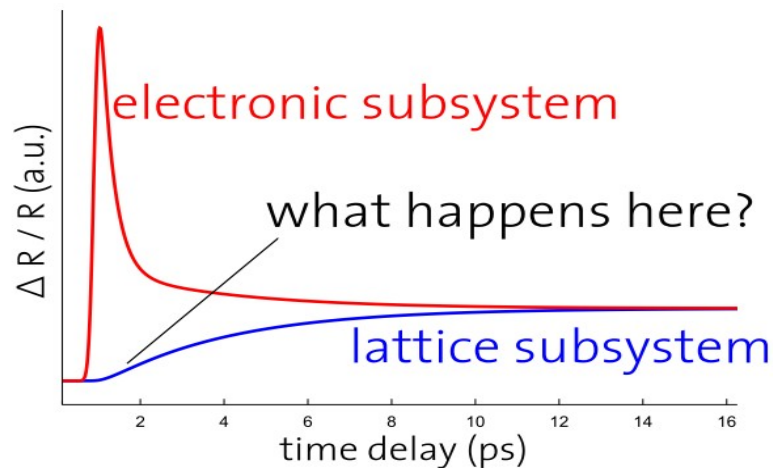


Motivation

Relaxation of hot carriers in condensed matter:



Phonon timescale can be **< 100 fs** (typical vibration periods of lattice ions)



Motivation

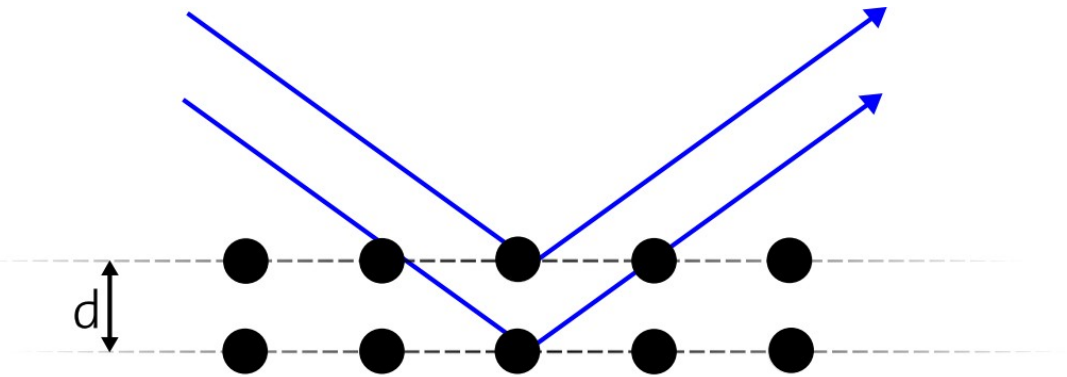
Goal: Study ultrafast phonon dynamics with sufficient **time** and **momentum** resolution

→ Use SwissFEL pulses for
Time resolved diffuse X-ray scattering

Diffuse X-ray Scattering

$$\vec{k}_{in} - \vec{k}_{out} = \vec{G}_{hkl}$$

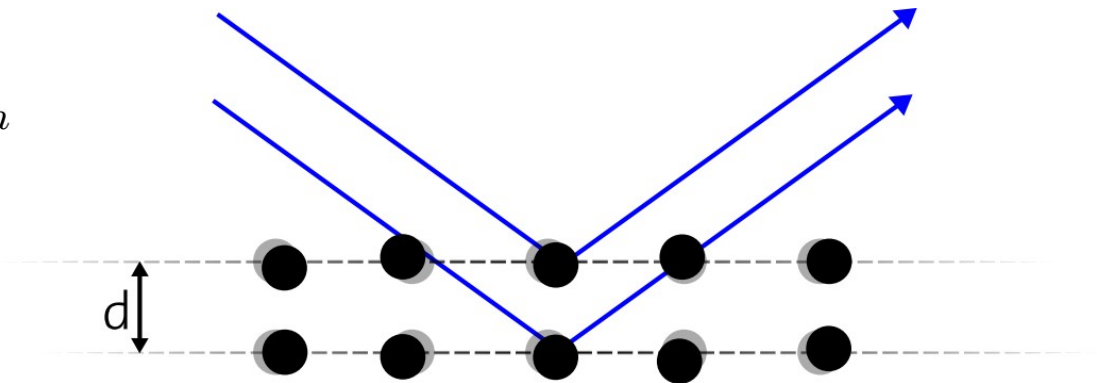
Lattice equilibrium positions



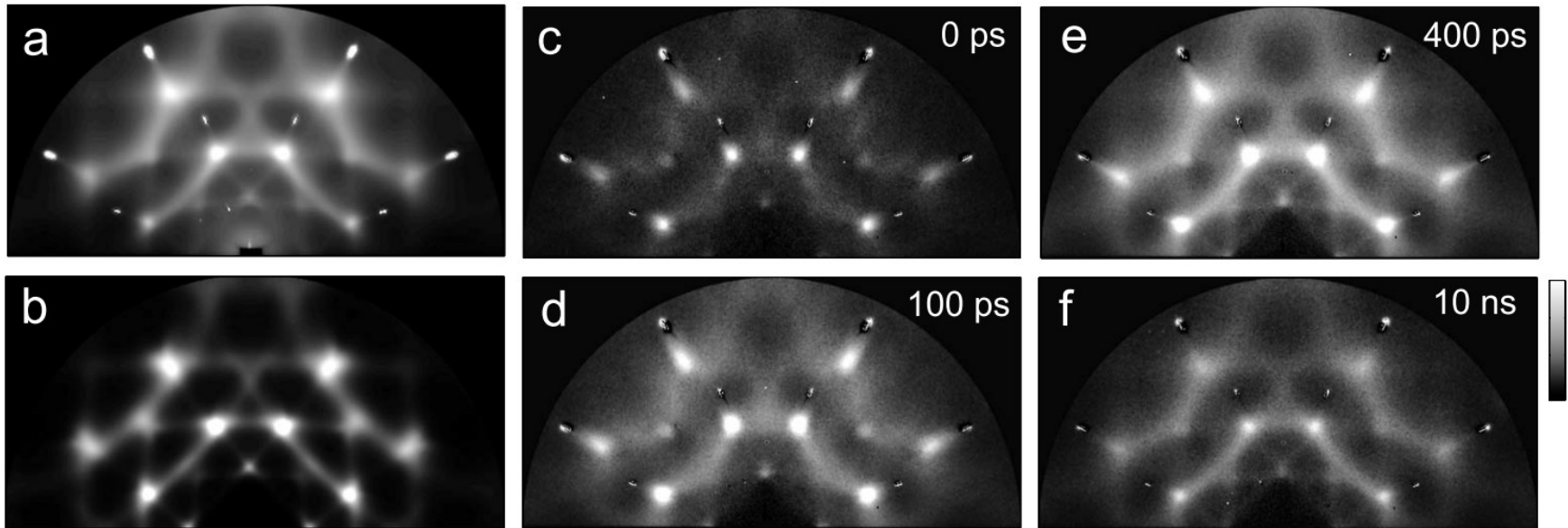
Diffuse X-ray Scattering

$$\vec{k}_{in} - \vec{k}_{out} = \vec{G}_{hkl} + \vec{q}_{phonon}$$

Lattice + phonons



Example

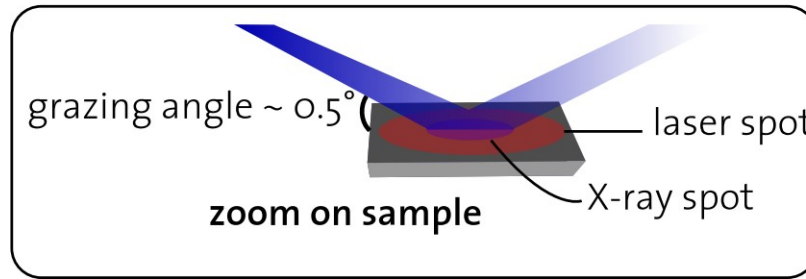
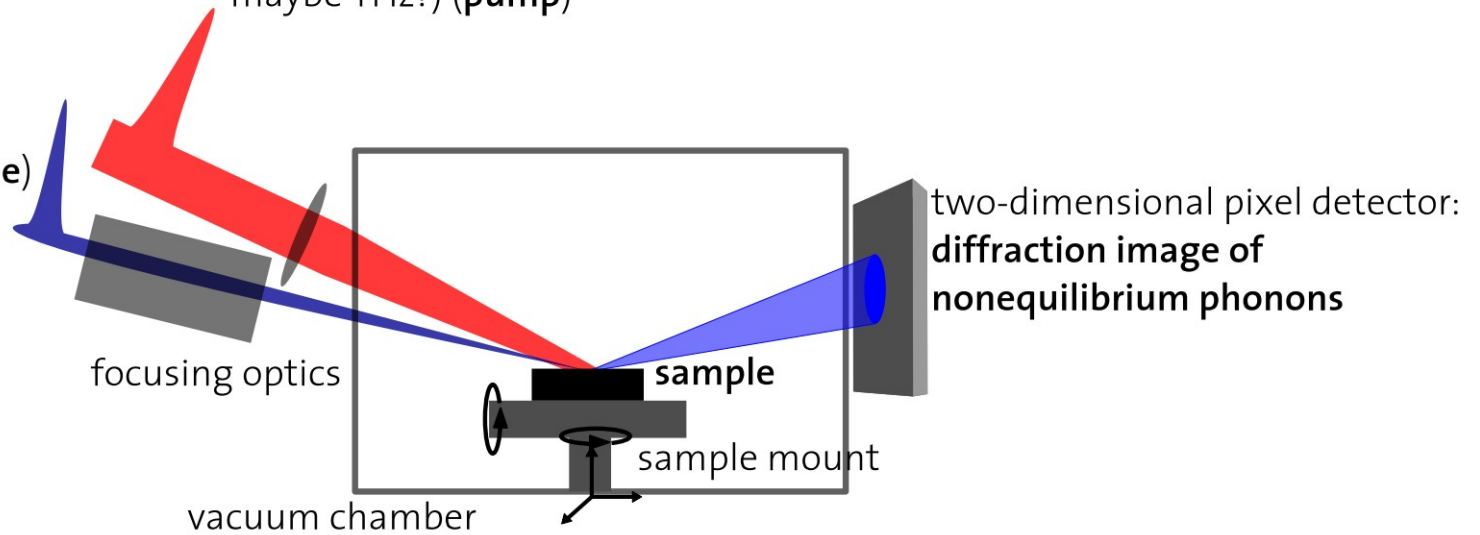


M. Trigo et al., Phys. Rev. B 82, 235205 (2010)

Set-Up

laser pulse (synchronized to X-ray pulse;
Ti:Sa fundamental, OPA
maybe THz?) (**pump**)

X-ray pulse (**probe**)



Crucial SwissFEL Parameters

- Timing jitter X-ray pulse (probe) – laser pulse (pump)
- Beam stability (grazing incidence geometry)
- 2D pixel detector