New possibilities for IXS with XFELO

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Squeezing New Juice from Old Fruit

$$S(\vec{Q},\omega) = \frac{1}{2\pi\hbar}\int_{-\infty}^{\infty} dt e^{-i\omega t}\left\langle \Delta\rho(\vec{Q},0)\Delta\rho^{+}(\vec{Q},t)\right\rangle$$

$$\Delta\rho(\vec{Q}) = \Delta\rho_0(\vec{Q}) + \Delta\rho_d(\vec{Q})$$

$$\Delta\rho_0(\vec{Q}) = -i\sum_l e^{-i\vec{Q}.\vec{R}_l}\vec{Q}.\vec{u}_l f(Q)$$

$$\Delta\rho_0(\vec{q}+\vec{G}) = -iA_{qj}(\vec{q}+\vec{G})\vec{e}_{qj} f(\vec{q}+\vec{G})$$

Deformation part is related to electron-phonon interaction

$$\Delta\rho_d(\vec{q}+\vec{G}) = \sum_{G'} \chi(\vec{q}+\vec{G},\vec{q}+\vec{G}')A_{qj}(\vec{q}+\vec{G}').e_{qj}W(\vec{q}+\vec{G}')$$

$$= \sum_{G'} \chi(\vec{q}+\vec{G},\vec{q}+\vec{G}')M(\vec{q}+\vec{G}')$$

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Can in principle study electron density response to electron phonon interaction for each phonon!

Pump with **q**, probe with **q+G**