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Thermal motion induced forbidden reflections

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Reflections forbidden by crystallographic rules can be observed when the energy of incident x-rays is tuned to an absorption edge of the material. When the site symmetry of the resonant atoms is such that dipole-dipole resonant scattering is also forbidden, one can still measure intensity at the position of the forbidden reflection: it is related to the transcient atomic displacements of the resonant atoms from their high-symmetry sites, due to thermal motion [1]. These so-called Thermal Motion Induced (TMI) resonant reflections have been measured in Germanium and Wurtzites crystals ZnO, GaN and CdSe [2,4]. The intensity can be reproduced with a single low energy optical phonon mode.
This experimental method can be used to measure atomic displacements correlations [3] and has potential applications to study systems with interesting electron-lattice coupling effects. It would benefit from the possibility to excite selectively a single optical phonon mode.

References:
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