3D mapping of reciprocal space and inelastic X-ray scattering.

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Combination of powder diffraction and Raman scattering allows to correlate average crystal structure with zone-center vibrations. With single crystals one could go beyond and measure diffracted intensity and inelastic scattering at any vector in reciprocal space. Inelastic scattering measurements, X-ray or neutron, are very time consuming. Diffraction could be measured fast with an area detector; but diffracted intensities are integrated over energy of the phonon system. Mapping of reciprocal space in diffraction experiment followed by inelastic X-ray scattering allows to locate vectors in reciprocal space with strong diffuse scattering signals and then uncover a vibrational contribution. This combination of methods will be illustrated with diffuse scattering in Mn-based Prussian Blue analogue, dynamic diffraction effects in Si, charge density wave in ZrTe_3 , and Kohn anomalies in Zn.