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Using phonons to decipher weak symmetry breaking in multiferroics

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Strongly correlated systems are characterized by the fact that their low energy properties are not driven by the delocalization resulting from their kinetic energy, but by the effect of Coulomb's repulsion between electrons. As a result they usually exhibit various ground-states that can be triggered using external conditions such as temperature, electric or magnetic fields, pressure, etc.

Among them are the magneto-electric multiferroic materials, that couple a polar order with magnetic properties. Such systems are characterised by weak symmetry breakings reponsible for the reversible polarisation. Unfortunately,diffraction techniques do not always allow to identify such weak distorsions and the proposed space groups are often over-symmetric, in disagreement with the existence of a measured polarisation.

We will show how carefull symmetry analysis, associated with thorough
comparison between measured and computed phonons modes, allow to decipher weak symmetry breakings and correct polar groups.

Examples will be taken with the CuO[2] and $\mathrm{BaFe_2Se_3}$[1] multiferroics compounds.

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