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Neutron scattering studies of phonon lifetime in SrTiO3

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$SrTiO_3$ is an incipient ferroelectric material with a large static dielectric response, which shows notable phonon anomalies and electrostrictive response (PRB 62, 13942). It is also a neutron triple-axis classic, with seminal work by Cowley, Shirane in which they show the application of available phonon theories and sixties neutron scattering methods.
First principles calculations of classic perovskites like $SrTiO_3$ and benchmarking with experimental data have been helpful to figure out a wide range of fundamental characteristics like the electronic origins of ferroelectricity, soft phonon modes and their role in the structural phase transition (PRB 77, 134111). However, the large deviation between phonon lifetime calculations and experimental data remains unanswered.
In this work, we try to resolve it by implementing unified methods, diagrammatic approaches and self-consistent phonon theory which include anharmonic effects (PRB 92, 054301). These calculations are compared to the neutron scattering measurements of the phonon line width in the cubic phase of $SrTiO_3$ at various temperatures. For these measurements two types of neutron spectrometers were used, the time of flight spectrometer Merlin at ISIS and the multiplexing spectrometer CAMEA at PSI. Data analysis has been done considering the instrumental resolution effects in the signal lineshape. Additionally, we will discuss the relevance and state of the art of neutron methods for the analysis of excitations lifetimes.

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