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Phonons in nanostructures studied by nuclear inelastic scattering and ab initio methods

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Recent developments in synchrotron radiation techniques enable to study dynamical properties of nanoscale systems such as thin films, nanoclusters, and nanowires.

Due to lower symmetry and dimensionality, the vibrational spectra of nano-systems may substantially differ from bulk crystals and strongly influence their thermo-elastic properties. Discovered 20 years ago, the nuclear inelastic scattering (NIS) provides complementary and sometimes superior information about lattice dynamics comparing to other well established techniques. The main advantages are: high selectivity, small sample volume, ultra-high vacuum conditions, variable energy resolution. Usually to obtain full information about lattice dynamics and properly interpret experimental results a reliable input from theory is required. A few examples of recent studies will be presented. They include the measurements and ab initio calculations of phonon spectra in very thin iron-oxide films and rare-earth nanostructures.

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