

# **Implementing Terahertz Phonon Manipulation: What Can We Learn From IXS Measurements?**

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In recent years, an increasing number of IXS investigations have been dealing with complex mesoscale structures, holding, in some cases, the promise of new functionalities. To outline some emerging trends in this field of research, I will discuss published or unpublished Inelastic X-Ray Scattering (IXS) investigations of the terahertz collective dynamics of inhomogeneous hybrid (liquid-solid) systems. These results indicate that the IXS spectrum has a non-trivial shape in which hydrodynamic acoustic-like modes are either suppressed or sided by additional, non-hydrodynamic ones. Most importantly, in the long run, the observed connection between this spectral behavior and the mesoscale arrangement might inspire new methods to steer acoustic propagation through the design of the nanoscale structure. Finally, I will highlight the critical role played by the Bayesian analysis in this emerging field of research, also illustrating some future directions.