

A microscopic insight onto phonon dynamics and thermal transport in disordered systems

Valentina M. Giordano

Institute Lumiere Matiere, University of Lyon and CNRS, Villeurbanne, France

* valentina.giordano@univ-lyon1.fr

Despite disordered systems have long been at the focus of scientific research, a microscopic understanding of many peculiar features, marking the difference between disordered and ordered systems, is still missing. Many are such properties, which still give rise to a lively debate, such as the nature of the glass transition, the microscopic mechanisms leading to the physical aging, the origin of disorder-specific vibrational and thermal anomalies...

Recent advanced synchrotron-related experimental techniques, able to capture the vibrational and relaxational properties of liquids and glasses down to a microscopic lengthscale and over typical times ranging from ps to s, have clearly shown the need of a multiscale investigation for significantly advancing the understanding of the physics of glasses.

Vibrational properties indeed will clearly depend on the probed lengthscale, the disorder starting to play a role only when the wavelength becomes comparable to the inter-atomic distance. Similarly, relaxational processes will be active or frozen depending on the comparability between the experimental probing time and the relaxation time.

In this lecture I will revise our experimental investigations of the last 10 years, based on top of the art synchrotron radiation techniques, allowing to probe different time and lengthscales, and identify the different dynamical regimes, and the corresponding key players determining vibrational and thermal properties in disordered systems.