

Brillouin Microscopy as a Tool for Probing Mechanics:
Principles and Implementations
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At the intersection of materials science and life sciences, understanding the mechanical response of complex systems is crucial for advancing fields such as mechanobiology, advanced biofabrication, and smart materials design. While traditional mechanical probing techniques often rely on physical contact or lack high-resolution 3D mapping capabilities, Brillouin microscopy has emerged as a powerful, non-destructive, and label-free all-optical alternative. This presentation focuses on the fundamental physical principles and the technical implementations of Brillouin microscopy, positioning it as an innovative sensing tool for interdisciplinary research.

We will first explore the underlying mechanisms of spontaneous Brillouin light scattering, detailing how inelastic photon-phonon interactions can be utilized to probe high-frequency (gigahertz) acoustic modes. By analyzing the Brillouin frequency shift, we can map the longitudinal elastic modulus of various samples in three dimensions. Furthermore, the talk will address the critical instrumentation challenges and optical setups required to extract meaningful measurements from complex biological specimens.

To conclude, we will discuss the correlation between data obtained from conventional mechanical testing techniques and Brillouin microscopy.