# Dielectric Properties of Lithium Niobate from mHz to Optical Frequencies

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One of the best-known ferroelectric materials is lithium niobate $LiNbO_3$ (LN). LN is a uniaxial ferroelectric crystallizing in the R3c space group. It is renowned for its strong electro-optical and photorefractive properties. These properties have made LN a candidate of choice for applications in photorefractive devices, holographic memories and surface acoustic wave (SAW), etc. Today a lot of literature is available on the optical properties of LN in the visible and infrared spectral ranges. However, reports tend to focus on a limited frequency range and a discussion of the dielectric properties over an extended frequency range is today still missing.

This presentation aims at filling some part of this gap by presenting the characterization of the dielectric permittivity depending on the crystal orientation over a broad frequency range: 1 mHz to 1 PHz ($\lambda$ = 300 nm) using impedance measurement, quasi-optical free-space characterization, THz time domain spectroscopy (THz-TDS) and optical ellipsometry.
Three different frequency ranges, separated by well visible resonances, are observed: low frequency “free-piezoelectric” response, intermediate frequency “clamped-ionic” response and high frequency “electronic” response. All of these features are discussed with an emphasis on the role of the crystallographic structure and piezoelectric response.