

Coherent lattice dynamics in LiNbO₃ induced by mid infrared laser driven ferroelectric polarization switching

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Ferroelectric materials are considered interesting candidates for non-volatile data storage showing below Curie temperature, a macroscopic electric polarization by shifts of oppositely charged ions due to a structural phase transition. Resonant large-amplitude excitation of a polar vibrational mode was recently shown to transiently reverse the ferroelectric polarization of LiNbO₃, possibly driven by anharmonic coupling to the ferroelectric mode [1]. We have performed fs x-ray diffraction experiments at the swissFEL bernina endstation to investigate accompanied lattice dynamics. The excitation of a LiNbO₃ crystal with mid infrared laser pulses triggered coherent lattice dynamics and a long lived shift of the -3-3-6 diffraction peak, depicted in figure 1a,b. Detailed simulations of the induced structure factor change and the triggered lattice dynamics are part of ongoing discussions to pave the way towards the use of LiNbO₃ as transducer for the ultrafast control of functional properties in heterostructures.

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[1] R. Mankowsky et al., Phys. Rev. Lett. 118, 197601 (2017)

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