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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 utlrafast control of functional properties in heterostructures.

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

Position

Postdoc

Primary author: SANDER, Mathias (PSI - Paul Scherrer Institut)

Co-authors: STAUB, Urs (Paul Scherrer Institut); Dr MANKOWSKY, Roman; LEMKE, Henrik Till; BEAUD, Paul (Paul Scherrer Institut)

Presenter: SANDER, Mathias (PSI - Paul Scherrer Institut)

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