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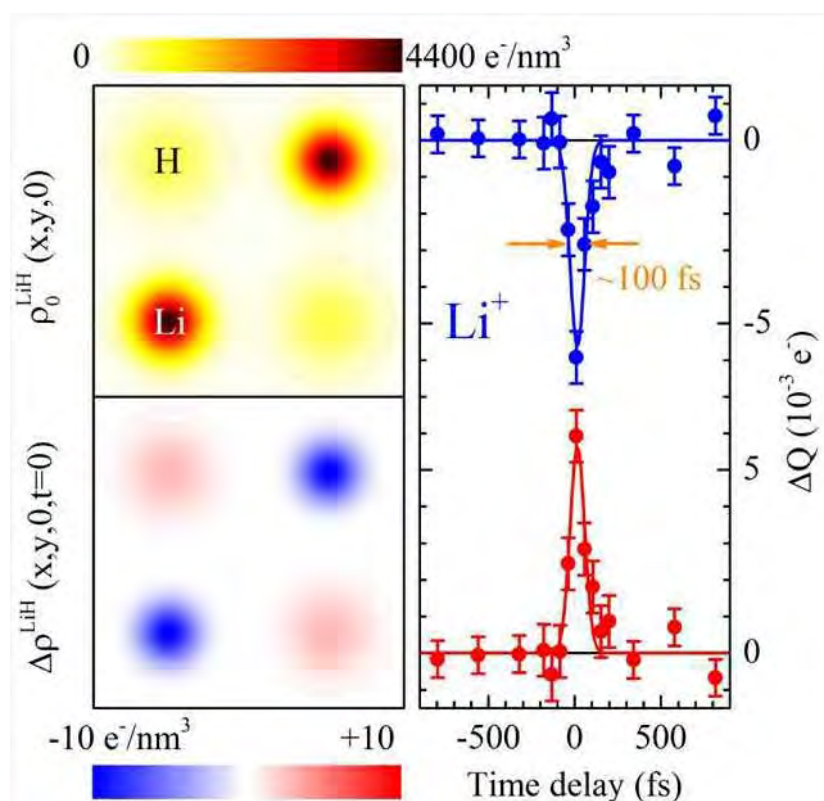
Transient electron density maps from femtosecond x-ray powder diffraction

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Ultrashort hard x-ray pulses are sensitive probes of structural dynamics on the picometer length and femtosecond time scales of electronic and atomic motions. Using short hard x-ray pulses as probe in a pump-probe scheme allow to do femtosecond x-ray diffraction experiments [1], which provide transient electron density maps at a femtosecond timescale with a sub-angstrom spatial resolution. In a typical femtosecond x-ray powder diffraction experiment many Debye-Scherrer rings, up to a maximum diffraction angle $2\theta_{\max}$, are recorded for each time delay between the optical pump and the hard x-ray probe. From the diffraction pattern, the change of the diffracted intensity of each rings are monitored. The interference of diffracted x-rays from the many unexcited cells, with known structure factors coming from steady-state measurement, and diffracted x-rays from the few excited cells allows for the detection of the transients structure factors. Problems could arise if the 3D-Fourier transform is directly used because of the abrupt end of the collected information in the reciprocal space (maximum diffraction angle $2\theta_{\max}$). In order to overcome this problem, the Maximum Entropy Method is apply to the data and the transient electron density maps are derived. We apply the femtosecond x-ray powder diffraction technique and the Maximum Entropy Method to study the induced transient polarization by high optical fields on ionic crystals. Such polarizations are connected to a spatial redistribution of electronic charge, which corresponds to a charge transfer between the two ionic compounds [2]. While the charge transfer originates from the anion to the cation in the LiBH and the NaBH₄, the LiH exhibits a peculiar behavior: the charge transfer occurs from the cation to the anion. As result from comparison with calculations in the COHSEX framework, this behavior is due to the strong electronic correlations in the LiH [3].

[1] F. Zamponi et al., *Opt. Express* 18, 947 (2010), [2] J. Stingl et al., *Phys. Rev. Lett.* 109, 147402 (2012), [3] V. Juvé et al., *Phys. Rev. Lett.* 111, 217401 (2013)



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