Abstract Submitted
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Dynamical reconstruction of the valence exciton in LiF[1] PETER ABBAMONTE, University of Illinois, WEI KU, Brookhaven National Laboratory, TIM GRABER, University of Chicago, JAMES REED, SERBAN SMADICI, University of Illinois, ABHAY SHUKLA, Universite Pierre et Marie Curie, JEAN-PASCAL RUEFF, Synchrotron SOLIEL — We have used inelastic x-ray scattering, coupled with recently developed inversion techniques, to reconstruct the structure and dynamics of the valence exciton in the prototype alkali halide LiF. Our inversions, which yield resolutions $\Delta x = 0.533\mathring{A}$ and $\Delta t = 20.67as(2.067 \times 10^{-17}s)$, reveal that the exciton forms in less than $50as$, oscillates with a period of $283as$, and decays after approximately $5fs$. It contains a pronounced $a/3$ internal periodicity, where $a = 4.027\mathring{A}$ is the crystal lattice parameter, that changes little during the course of its life, indicating that this exciton lies very close to the Frenkel limit. Our results resolve a 70 year old contraversy about the valence exciton in alkali halides and, when compared to *ab initio* calculations, demonstrate a simplified theoretical approach to describing excitons in the limit of strong binding energy.

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