Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Collective coherent control: Synchronization of polarization in ferroelectric $PbTiO_3$ by shaped THz fields[1] TINGTING QI, YOUNG-HAN SHIN, KA-LO YEH, NELSON KEITH, RAPPE ANDREW, DEPARTMENT OF CHEMISTRY, UNIVERISTY OF PENNSYLVANIA TEAM, DEPARTMENT OF CHEMISTRY, MASSACHUSETTS INSTITUTE OF TECHNOLOGY TEAM —
Coherent optical control over ultrafast molecular behavior including chemical reactions has been explored in recent years, spurred by the application of optimal control theory and related methods and by the development of femtosecond pulse shaping techniques through which complex optical waveforms have been crafted and optimized to induce specified molecular responses. Here we propose and model theoretically the extension of coherent control to collective structural change. We show that properly shaped terahertz fields, resonant with selected lattice vibrational frequencies, could be used to move ions in ferroelectric crystals from their positions in an initial domain orientation along well defined collective microscopic paths into the positions they occupy in a new domain orientation. Collective coherent control will enable direct observation of fast highly nonlinear material responses and far-from-equilibrium structures that can be harnessed in electro-optic devices and non-volatile computer memory.

[1]This work was supported by ONR, NSF, DOE and HPCMO.

Tingting Qi
University of Pennsylvania

Date submitted: 20 Nov 2008 Electronic form version 1.4