Abstract Submitted
for the 4CF15 Meeting of
The American Physical Society

Probing thermal transport at the nanoscale: the collectively-diffusive regime JORGE NICOLAS HERNANDEZ CHARPAK, TRAVIS FRAZER, JOSHUA KNOBLOCH, Univ. of Colorado Boulder- JILA, WEILUN CHAO, CXRO - LBNL, MARGARET MURNANE, HENRY KAPTEYN, Univ. of Colorado Boulder- JILA — How is thermal transport modified by the geometry of nanostructured systems? Our research seeks to answer this question and gain a deeper understanding of phonon dynamics, the main heat carriers in semiconductor and dielectric materials. Today, advances in nanofabrication make it possible to pattern nanostructures with dimensions <10nm, much smaller than the phonon mean free path in many materials. At these length scales, Fourier's law of heat diffusion cannot accurately describe the thermal dynamics of even simple systems, and experimental results are needed to guide theoretical efforts. In order to study nanoscale thermal transport at its characteristic length- and time-scales, we take advantage of the tabletop high harmonic generation (HHG) process to generate ultrashort, coherent, extreme ultraviolet (EUV) probe light. The short wavelength of EUV beams is sensitive to picometer thermal deformations of the surface; and the femtosecond duration of HHG pulses is fast enough to capture sub-picosecond thermal dynamics of nanostructured systems. We follow the heat dissipation away from periodic arrays of metallic nanowires (20-1000nm wide) on top of both silicon and sapphire substrates. By comparing the thermal relaxation of nanowire arrays of the same linewidth but different periodicities, we confirm the predictions of the recently uncovered *collectively-diffusive* regime: closely-spaced nanowires cool faster than widely-spaced ones.

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Date submitted: 10 Sep 2015 Electronic form version 1.4