Abstract Submitted
for the SHOCK11 Meeting of
The American Physical Society

Temperature measurement in condensed phases using femtosecond stimulated Raman scattering NHAN DANG, Los Alamos National Laboratory, SHOCK AND DETONATION PHYSICS GROUP TEAM — The primary motivation for this work is the desire to observe the initial evolution of temperature following shock loading that occurs on the picosecond time scale, which may be crucial in determining the shock-induced reaction mechanism in explosives. In this presentation, we show that the Stokes to anti-Stokes intensity ratio of femtosecond stimulated Raman scattering (FSRS) data can be used to measure vibrational temperatures in condensed phases. We have validated a decades old, yet untested, theoretical prediction by studying the temperature dependence of FSRS in a calcite single crystal from cryogenic to room temperature. Experimental results of Raman loss to Raman gain ratios for low frequency modes as a function of temperature are presented and shown to be in agreement with theoretical predictions. We also report temperature jump measurements following a femtosecond ultraviolet pump pulse, demonstrating that FSRS can measure the nonequilibrium time evolution of mode specific vibrational temperatures. These measurements require no material dependent parameters or prior calibration, and should be universally applicable.

Nhan Dang
Los Alamos National Laboratory

Date submitted: 16 Feb 2011 Electronic form version 1.4