Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Photon energy and carrier density dependent dynamics of the coherent A1g phonon in bismuth CRYSTAL BRAY, Stanford University PULSE Institute, EAMONN MURRAY, STEPHEN FAHY, Tyndall National Institute, University College Cork, DAVID REIS, Stanford University PULSE Institute — We investigate the dynamics of the coherent A1g phonon as a function of photon energy and carrier density for photo-excited single-crystal thin-film bismuth. Previous experimental and theoretical studies on group V semimetals such as bismuth show strong softening of the mode with photo-excitation associated with electronic softening and a reduction in the Peierls distortion; however, theoretical models differ on the detailed dependence for how the carriers populate the conduction band states immediately following excitation [Murray et al., Phys. Rev. B **72,** 060301 (2005); Zijlstra et al., Phys. Rev. B **74,** 220301 (2006); Sheu et al., Phys. Rev. B **87,** 075429 (2013)]. By carefully controlling the total energy deposition and the incident photon number as a function of different pump wavelengths, we are able to test two different models for the filling near the Fermi surface: a one-chemical potential model whereby the carrier density depends on electronic temperature and a two-chemical potential model whereby the carrier density depends on the number of photons absorbed. We find evidence that neither model suffices, likely due to different relaxation mechanisms depending on which bands are involved in the initial excitation.

Crystal Bray
Stanford University PULSE Institute

Date submitted: 15 Nov 2013 Electronic form version 1.4