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Dynamical behavior of coherent phonons in semimetals: Measuring fast electron decoherence rates with slow pulses JIAN CHEN, Stanford PULSE Institute, SLAC National Accelerator Laboratory, JINGJING LI, Department of Physics, University of Michigan, STEPHEN FAHY, Department of Physics, University College Cork, Ireland, ROBERTO MERLIN, Department of Physics, University of Michigan, DAVID REIS, Stanford PULSE Institute, SLAC National Accelerator Laboratory — Coherent light illumination of solids above the band-gap leads not only to a population of photoexcited carriers, but also to the generation of coherent electronic states of particular symmetries which can drive vibrations of the same symmetry. For A1g and Eg symmetry phonons in Bi and Sb, there has been some controversy regarding the generation mechanism of coherent vibrations. Here, we use a combination of ultrafast stimulated Raman scattering (RS) and cw spontaneous RS to determine the lifetime of electronic coherences of A1g and Eg symmetry. Their lifetime can be inferred from a comparison between pump-probe measurements of the amplitude of the corresponding coherent phonons, and a determination of the spontaneous RS cross sections. Our results represent a new approach to probe extremely fast electron decoherence rates using much slower (50-100fs FWHM) laser pulses. The Eg electronic coherence, resulting from a fragile unequal distribution of carriers in three equivalent regions of the band structure, is extremely short lived. Its temperature-dependent lifetime is in the range 2-12 fs in Bi and 5-12 fs in Sb.

Jian Chen
Stanford PULSE Institute, SLAC National Accelerator Laboratory

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