ABSTRACT: Ultrafast light excitation is proving to be a powerful tool to manipulate electronic, spin, and structural behavior in solids. The key is tailoring light pulses to selectively pump a specific excitation channel without introducing quasiparticle heating. I will discuss two different methods to support superconductivity in cuprate superconductors using mid-infrared light that targets lattice phonon excitations. In the lanthanide cuprate La1.8-xEu0.2SrxCuO4, superconductivity is suppressed around x = 1/8 doping by charge and spin stripe order that is stabilized in the CuO2 planes by underlying lattice distortions. By targeting an in-plane Cu-O stretching mode, charge order can be suppressed and superconductivity reintroduced throughout the charge ordered regime. The relaxation dynamics of the light-induced phase reveals information about how superconductivity competes with the ground state. In YBa2Cu3O6+x, a different phonon excitation, this time of the apical oxygen atoms that sit above and below pairs of CuO2 planes, appears to support superconductivity. This is measured as enhanced Josephson coupling between pairs of CuO2 planes and a corresponding blue shift in the Josephson plasma mode. Surprisingly, this same excitation generates a plasma mode very similar to the Josephson mode even far above the superconducting transition temperature, throughout the pseudogap phase. I will discuss how the relaxation pathway of this mode points to a Josephson tunneling origin and explore possible mechanisms driving the formation of this state.

BIO: Cassandra Hunt is a Miller Research Fellow at the University of California, Berkeley. She joined as a fellow in October 2015 after completing her Ph.D. in condensed matter physics at the University of Illinois at Urbana-Champaign, in the group of Laura Greene. From fall 2010 through 2014, she worked primarily in collaboration with the lab of Andrea Cavalleri at the Max Planck Institute for Structure and Dynamics of Matter in Hamburg, Germany. Her research focuses on using selective, ultrafast light excitation to manipulate material properties in correlated systems. Cassandra is interested both in using light to control material behavior and also as a tool to understand phase competition in the ground state of complex materials. As a part of her postdoc, she is working with Alessandra Lanzara to construct a new system to combine high-intensity, tailored light excitation with time-resolved, angle-resolved photoemission spectroscopy (ARPES).