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Ultrafast studies of coexisting electronic order in cuprate superconductors JAMES HINTON, UC San Diego, ERIC THEWALT, UC Berkeley, LBNL, ZHANYBEK ALPICHSHEV, MIT, AARON STERNBACH, ALEX MCLEOD, UC San Diego, L. JI, MIKE VEIT, CHELSEY DORROW, University of Minnesota, JAKE KORALEK, SLAC, LBNL, XUDONG XHAO, Jilin University, NEVEN BARISIC, CEA Saclay, ALEXANDER KEMPER, North Carolina State University, LBNL, NUH GEDIK, MIT, MARTIN GREVEN, University of Minnesota, DIMITRI BASOV, UC San Diego, JOE ORENSTEIN, UC Berkeley, LBNL
— The cuprate family of high temperature superconductors displays a variety of electronic phases which emerge when charge carriers are added to the antiferromagnetic parent compound. These electronic phases are characterized by subtle differences in the low energy electronic excitations. Ultrafast time-resolved reflectivity (TRR) provides an ideal tool for investigating the cuprate phase diagram, as small changes in the electronic structure can produce significant contrast in the non-equilibrium reflectivity. Here we present TRR measurements of cuprate superconductors, focusing on the model single-layer cuprate $HgBa_2CuO_{4+\delta}$. We observe a cusp-like feature in the quasiparticle lifetime near the superconducting transition temperature Tc. This feature can be understood using a model of coherently-mixed charge-density wave and superconducting pairing. We propose extending this technique to the nanoscale using ultrafast scattering scanning near-field microscopy (u-SNOM). This will allow us to explore how these electronic phases coexist and compete in real-space.

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