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Light-induced non-equilibrium superconductivity throughout the pseudogap phase of cuprates

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In this talk I will discuss some of our recent work aimed at controlling superconductivity in the High Tc cuprates with light.
High-field THz and mid-infrared radiation are used to manipulate low frequency excitations in the superconducting and in the underdoped phases.
The first key result is that ordered states that compete with superconductivity, such as for instance the striped phase in LESCO ant 1/8 hole doping, can be melted with light, making superconductivity emerge on the ultrafast timescale. Ultrafast soft x-ray scattering experiments with the Stanford LCLS X-ray Free Electron Laser allow for a hierarchy of events to be established, clocking and quantifying the relaxation of lattice and charge order.
In recent experiments, transient superconductivity is been demonstrated throughout the pseudogap phase of YBCO, including at room temperature for the underdoped O6.5 compounds. In this case, the underlying physical picture is less clear than in the LESCO case, but it may be connected to the effect of coherent modulation of the microscopic electronic properties through coherent excitation of the apical oxygen postion. A straightforward conceptual analogy can be found with experiments that that study driven dynamics of strongly correlated atomic gases in optical lattices.

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