

# Quantum Materials in the Time Domain

*Interviene*

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## Abstract

With its direct correspondence to the electronic structure, angle-resolved photoemission spectroscopy (ARPES) is a ubiquitous tool for the study of solids. When extended to the temporal domain, time-resolved ARPES offers the potential to move beyond equilibrium properties, exploring both the unoccupied electronic structure as well as its dynamical response under ultrafast perturbation. Historically, ultrafast extreme ultraviolet sources have required compromises that make it challenging to achieve a high energy resolution, while producing sufficiently high photon energies and flux. In this talk I will discuss novel opportunities arising from the development of ultrafast laser-based sources generating ultraviolet photons in the 6-40 eV range, with 190 fs and 20 meV time and energy resolutions, respectively [1]. On the high-temperature superconducting cuprates, we have obtained evidence for the collapse of superconductivity via ultrafast quenching of phase coherence [2], as well as of the emergence of the pseudogap from short-range spin-correlations in electron doped cuprates [3]. We have also developed a novel approach for the direct determination of mode-projected electron-phonon coupling in the time-domain, and demonstrate its application to the case of graphite and its Dirac-like dispersion [4]. Measuring the characteristic time scale for quantized energy-loss processes of photo-injected electrons at the K point allows for the direct, quantitative extraction of the electron-phonon matrix elements, for specific modes, and with unprecedented sensitivity [4].

[1] A.K. Mills et al., Rev. Sci. Instrum. 90, 083001 (2019).

[2] F. Boschini et al., Nature Materials 17, 416 (2018).

[3] F. Boschini\*, M. Zonno\*, et al., arXiv:1812.07583 (2018).

[4] M.X. Na et al., arXiv:1902.05572 (2019).

## Seminario

**Venerdì 11 ottobre 2019**

**Sala Riunioni, ore 12.00**

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