

# From X-rays to THz: Multicolor pump-probe experiments at FLASH

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**Abstract:** Recently, free-electron laser (FEL) X-ray sources with unprecedented parameters in terms of pulse length, photon flux, and coherence in an extremely wide spectral range have become routinely available for users. FLASH, the worldwide first soft X-ray FEL, has been operating as a user facility since 2005. It is based on superconducting accelerator technology and generates up to ~8000 soft X-ray pulses per second with energies up to ~0.5 mJ. These pulses can be combined with strong THz, optical or higher harmonic FEL pulses allowing to study ultrafast dynamics (fs-ps) in matter on its intrinsic length-scales (nm-um). They can be used to trigger (“pump”) and even uniquely control and then probe a variety of processes that range from fundamental dynamics in individual atoms and molecules, through phase transitions in solids to a wealth of interactions in biological materials.

The presentation gives an overview of the instrumentation and methods available at FLASH for multicolor pump-probe experiments and highlights some recent examples that illustrate these concepts.