Investigating dynamic processes with intense x-ray pulses

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The novel x-ray free-electron laser (XFEL) sources offer new opportunities for the investigation of ultrafast phenomena in the chemical, materials, and biological sciences. The high number of photons (10^12) per pulse in combination with femtosecond or even attosecond pulse length allows new approaches in x-ray based imaging and spectroscopy. I will start with presenting some recent examples of ultrafast imaging, including single-shot imaging of single nanometer-sized particles and novel holographic approaches. I will then present recent work on multi-pulse and non-linear x-ray spectroscopy and I will finish with presenting the new opportunities for such experiments at the new Athos branch currently being built at SwissFEL.