Towards table-top time-resolved soft x-ray microscopy imaging with a laboratory high-harmonic source at 100 eV

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Nowadays soft x-ray microscopy is well established at synchrotron radiation sources [1] as well as at laboratory scale [2]. Many different techniques for specific applications and contrast mechanisms have been developed. However, these x-ray microscopy techniques are rarely connected to time-resolved measurements, i.e. combining a high spatial with a temporal resolution by employing visible-pump x-ray-probe measurements. One reason for this is the lack of brilliant soft x-ray sources delivering sufficiently short pulses in the fs-domain. In this contribution we demonstrate imaging with a laser driven table-top soft x-ray microscope. By combining a high-harmonic light source, optimized for having a maximum brightness at around 100~eV, a multilayer-mirror setup as a condenser and a zone plate as microscope objective, we were able to resolve 200~nm structures of a diatom sample [3]. Due to the pulsed nature of the high-harmonic radiation the microscope offers the possibility of adding a temporal resolution to established microscopy techniques like, e.g. high-resolution imaging or spectromicroscopy. The pulse duration in the order of a few femtoseconds or even below [4] allows for studying ultrafast processes not easily accessible with conventional synchrotron sources. Further development of the high-harmonic sources will extend the wavelength range into the water window region [5] enabling time-resolved microscopy at the carbon K-edge.

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