Movies of nanoscale dynamics by extreme ultraviolet microscopy

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Table-top full-field microscopes operating at extreme ultraviolet and soft x-ray (EUV/SXR) wavelengths can routinely image nanostructures and biological specimens with a spatial resolution better than 50 nm [1,2]. This high spatial resolution, combined with the recent demonstration of single laser shot imaging [3], opens the possibility for these laboratory-based microscopes to implement time-resolved imaging of repetitive nanoscale dynamics. Here, we demonstrate the capability to make movies of nanoscale dynamics from a sequence of time-synchronized EUV single shot images.

In a proof of principle experiment, the motion of an electrically driven cantilever tip, 60 nm in diameter, was characterized was captured with a single laser shot using a full field EUV microscope operating in transmission configuration. [1] The periodic motion of the cantilever tip driven by a 0.6 V\textsubscript{RMS}, 269.8 kHz signal was reconstructed from these images. The position of the tip with respect to the a reference surface is singularly determined along its periodic motion with ±24 nm accuracy. The recent demonstration of pulse energies above 10 μJ at λ = 13.9 nm from table-top lasers with duration shorter than 5 ps extends the possibility of time-resolved imaging of nanostructure dynamics to the GHz range with sub-30 nm spatial resolution [1,3].


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