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Extended reflection coherent diffraction imaging of nanostructures on a tabletop[1] BOSHENG ZHANG, MATTHEW SEABERG, DENNIS GARDNER, ELISABETH SHANBLATT, MARGARET MURNANE, HENRY KAPTEYN, DANIEL ADAMS, Univ of Colorado - Boulder — We demonstrate the most general form of reflection-mode coherent diffraction imaging (CDI) that is applicable to non-isolated samples at high numerical aperture, by combining ptychography CDI with tilted plane correction. Tabletop high harmonic (HHG) beams at 30 nm with curved wavefronts are used to illuminate Ti nano-patterns on a Si substrate, at 45 degree incident angle. High fidelity images of the nanostructures are reconstructed, giving quantitative information for both the amplitude and phase (i.e. height to $\approx$1 nm precision), at a spatial resolution of $\approx$ 150 nm (limited by the geometry). The images compare favorably with both scanning electron and atomic force microscopies. Combined with our previous transmission-mode results, we have a general full-field, non-destructive, tabletop ultrafast microscope. In the future, we can improve the resolution using shorter wavelength HHG to image nanostructures with sub-10 nm spatial resolution and femtosecond time resolution, to capture ultrafast magnetic dynamics and heat transport at the nanoscale.

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Bosheng Zhang
Univ of Colorado - Boulder

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