

# Near-field ptychography: phase retrieval for inline holography using a structured illumination

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Inline holography or propagation-based phase-contrast is commonly used as a phase-contrast imaging method at synchrotrons to image weakly absorbing objects or to visualize small density differences in a sample. Its application is especially simple since the phase signal is transferred to measured intensities through free-space propagation and requires no other image forming optical elements. However, phase retrieval of the sample's phase image remains challenging, especially for strongly refracting objects. Here, we present a novel approach to simultaneously retrieve the sample's complex-valued transmission function and the incoming illumination function from Fresnel diffraction patterns by using the measurement diversity created by lateral translations of the sample with respect to a structured illumination. The reconstruction approach is in essence identical to that employed in far-field ptychography. We show first results obtained with hard X-rays from synchrotron experiments and simulations and demonstrate the reduction of reconstruction artefacts and relaxation of constraints on the scattering properties of the sample. We believe that our method will tremendously improve the robustness of x-ray phase tomography.