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Phase Retrieval for X-Ray Near-field Holography beyond Linearisation

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X-ray near-field holography (NFH) is a propagation based coherent phase contrast imaging technique which does not rely on an image forming optic. Implementing NFH in a divergent beam created by nano focusing optics allows the application for microscopy. The magnification and field of view are straightforwardly controlled by geometrical parameters. This allows the easy measurement of overview and zoom images of the same specimen. However, this image has to be obtained by carrying out the phase retrieval on the measurements. For high resolution synchrotron experiments, phase retrieval is largely based on the single step reconstruction using the contrast transfer function approach, as introduced almost twenty years ago. Notwithstanding its tremendous merits, this scheme makes stringent assumptions on the optical properties of the object, requiring in particular a weakly varying phase. In this contribution we show how significant the loss in image quality becomes, if these assumption are violated, and how phase retrieval can easily be improved by a simple scheme of alternating projections. Importantly, the approach demonstrated here uses the same input data and constraint sets as the conventional CTF-based phase retrieval, and is particular well suited for the holographic regime.

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