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Phase retrieval in 3D tomographic imaging of biological objects using hard X-ray Bragg Magnifier Microscope

We present an alternative method for 3D tomographic imaging of microscopic biological objects in hard X-ray regime, based on Bragg Magnifier (BM) principle. BM microscope uses crystals to magnify X-ray beam resulting in advantages such as shorter propagation distances and increased dose efficiency, while achieving decent spatial resolution. This work focuses on the 3D reconstruction method to interpret the X-ray tomographic holograms using single-distance phase retrieval algorithm developed specifically for Bragg Magnifier, which is followed by filtered back-projection. We have adapted the contrast transfer function approaches for our purposes and in combination with iterative constraint-based phase retrieval algorithm we obtained faster and more robust reconstruction method. Our algorithm was successfully applied to both synthetic and real-world experimentally measured holograms of biological specimen. We reached isotropic 3D spatial resolution of 300 nm approaching theoretical resolution limit for the given experimental setup.

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