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Design and Implementation of an Optical Ptychographic Microscope for quantitative bio-imaging at La Trobe University

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Ptychography is a method for quantitatively determining the phase of a samples' complex transmission function. The technique relies upon the collection of multiple overlapping coherent diffraction patterns from laterally displaced points on the sample. The overlap of measurement points provides complementary information that significantly aids in the reconstruction of the complex wavefield exiting the sample. Moreover the method is sufficiently robust to simultaneously recover both the sample and probe functions from a single dataset.

Ptychography was initially realised for applications involving electron microscopy (Hoppe et al., Acta Cryst. A, 1969) but has been widely adopted by the x-ray lensless imaging community. More recently, it has found application in the optical regime (e.g. Godden et al. Optics Express, 2014) where it can be applied to 2D and 3D quantitative phase contrast imaging of weakly interacting specimens.

Here we describe and demonstrate the realisation of a high-quality optical ptychographic microscope at La Trobe University comprising 'off the shelf' components. Our microscope provides quantitative sample information with extreme sensitivity opening up a range of applications including bio-mechanical measurements on cellular samples. Some recent results using this microscope are showcased here.

Keywords

Ptychography, CDI, Biological, Imaging, La Trobe

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