

MONASH CENTRE FOR ELECTRON MICROSCOPY

Quantitative comparison for weak phase objects of
HRTEM and Electron ptychography using detective
quantum efficiency

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Venue: School of Physics and Astronomy,

Large Seminar Room, 10 College Wlk, Clayton-1-107

Abstract

Electron ptychography in the scanning transmission electron microscope (STEM) has been demonstrated to be capable of providing low-noise phase images of beam sensitive materials at low dose. For such materials, in particular biological samples, conventional high-resolution transmission electron (HRTEM) is the most widely used approach - usually cryo-TEM. The question then arises of whether ptychography or HRTEM offers the most dose-efficient imaging approach.

While resolution can be a useful measure for comparing imaging techniques, it is dependent on the electron dose. For some electron microscopy techniques, a phase contrast transfer function (PCTF) can be defined to quantify the technique's performance with respect to spatial frequency. However, the PCTF also does not account for the dose used and is not uniquely defined for common electron ptychography techniques like the Wigner distribution deconvolution (WDD) method. We introduce the detective quantum efficiency (DQE), applied to electron microscopy as a dose independent and sample independent measure of technique performance. The DQE of both HRTEM and electron ptychography has been obtained both analytically and via simulations.



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