



Contribution ID: 300

Type: **Invited presentation**

X-ray ptychography using a lab source

Wednesday 30 June 2021 13:30 (50 minutes)

X-ray ptychography is a scanning coherent diffraction imaging technique that is capable of obtaining quantitative electron density maps at the nanoscale. The technique has been proven to achieve resolutions beyond the limitations of conventional x-ray optics and has been applied to a wide range of scientific fields: from life science to environmental science, and magnetism. Until now the technique has been available only at large synchrotron facilities due to the levels of coherent beam required, with limited and competitive access.

Here we present the first X-ray ptychography images obtained using a laboratory X-ray source. The experiment was performed at the Soft Matter Analytical Laboratory in Sheffield with a Ga liquid metal-jet source. The hyperspectral detector used for recording the diffraction patterns in the far field, allowed characterising the spectral properties of the source. The sample was scanned in a 20 x 20 raster grid at 1 μm step using a 5 μm illumination size.

The results prove the robustness of the ptychographic imaging technique in low coherent flux and low stability conditions. This is the first step toward unlocking a powerful technique to the laboratory environment for serving a broader scientific community and enlarging the range of applications.

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Session Classification: Invited lectures

Track Classification: Applications