Stony Brook University
The Graduate School

Doctoral Defense Announcement

Abstract

X-ray Di□raction Microscopy: Computational Methods

and Scanning-type Experiments

By

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X-ray Diffraction Microscopy (XDM) has been gaining in popularity for nanoscale imaging of biological and material science samples. Its high penetration depth (compared to electron microscopy) and its good dose efficiency (compared to its lens-based X-ray alternative) make it uniquely suited for imaging whole biological specimens, where radiation damage is a concern. Despite these advantages, XDM is still far from being a routine imaging tool. This is due to the computational challenge of reconstructing an image from recorded diffraction intensities as well as difficult-to-satisfy experimental requirements.

I address these challenges by improving on the computational methods and by implementing a more reliable experimental geometry for our existing diffraction microscope at the Advanced Light Source, Lawrence Berkeley Lab. First, a software library has been developed that streamlines the post-experiment processing of data and that improves on an important aspect of data analysis. Results will be shown that illustrate the collective improvement to the reconstruction process. A modified version of a tool commonly used to assess the consistency of reconstructions is proposed and criteria of its validity are derived. Results show that it has improved utility for judging reconstruction quality. Second, a scanning-type experimental setup has been implemented for our existing diffraction microscope. Several possible geometries are discussed and preliminary results from recent experimental data are shown.

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