

# APS Scientific Computation Seminar Series

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Title: New Coherence Imaging Through Accelerated Algorithms

Date: Monday, October 19, 2015

Time: 1:00 p.m.

Location: 401/A1100

Hosts: Nicholas Schwarz and Brian Toby

## Abstract:

Recent advances in microscopy, specifically higher spatial resolution and data acquisition rates, require faster and more robust reconstruction algorithms. Ptychography is a phase retrieval technique for reconstructing the complex transmission function of a specimen from a sequence of diffraction patterns in visible light, X-ray, and electron microscopes. As technical advances allow larger fields to be imaged, computational challenges arise for reconstructing the correspondingly larger data volumes. Waiting to postprocess datasets offline results in missed opportunities.

We'll first present a parallel method for real-time ptychographic phase retrieval. It uses a hybrid parallel strategy to divide the computation between multiple graphics processing units (GPUs). A final specimen reconstruction is then achieved by different techniques to merge sub-dataset results into a single complex phase and amplitude image. Then we'll show how rapid reconstructions enabled beamline scientists to push the boundaries of their scanning geometries and modes. Namely, experiments combining ptychography with X-ray fluorescence mapping to deduce a specimen's structure and elemental composition at the same time, and fly-scan ptychography. Finally, ongoing and future collaborations with the APS will be discussed, highlighting the opportunities available with the upcoming APS upgrade, and available computational resources.