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Every factor helps: Rapid Ptychographic Reconstruction

YOUSSEF NASHED, Argonne National Laboratory

Recent advances in microscopy, specifically higher spatial resolution and data acquisition rates, require faster and more robust phase retrieval reconstruction methods. 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. Here we 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. Results are shown on a simulated specimen and real datasets from X-ray experiments conducted at a synchrotron light source.