

Compressed sensing applied HAADF STEM tomography

High angle annular dark field scanning transmission electron microscopy (HAADF STEM) is an imaging mode in electron microscopy that is excellently suited for atomic resolution imaging. Small wonder it has been the method of choice for atomic resolution tomography for a few years now.

Evidence is mounting that compressed sensing (CS) can greatly improve the results. In CS the original signal (the atomic object in this case) can be retrieved from far fewer measurements than prescribed by the Nyquist theorem, and hence beam damage could be reduced. The requirement being that the signal is sparse, i.e. is represented by many zeros in a certain basis set.

In this project, an algorithm is developed that not only applies sparsity to the sought-after object in new and more efficient ways.

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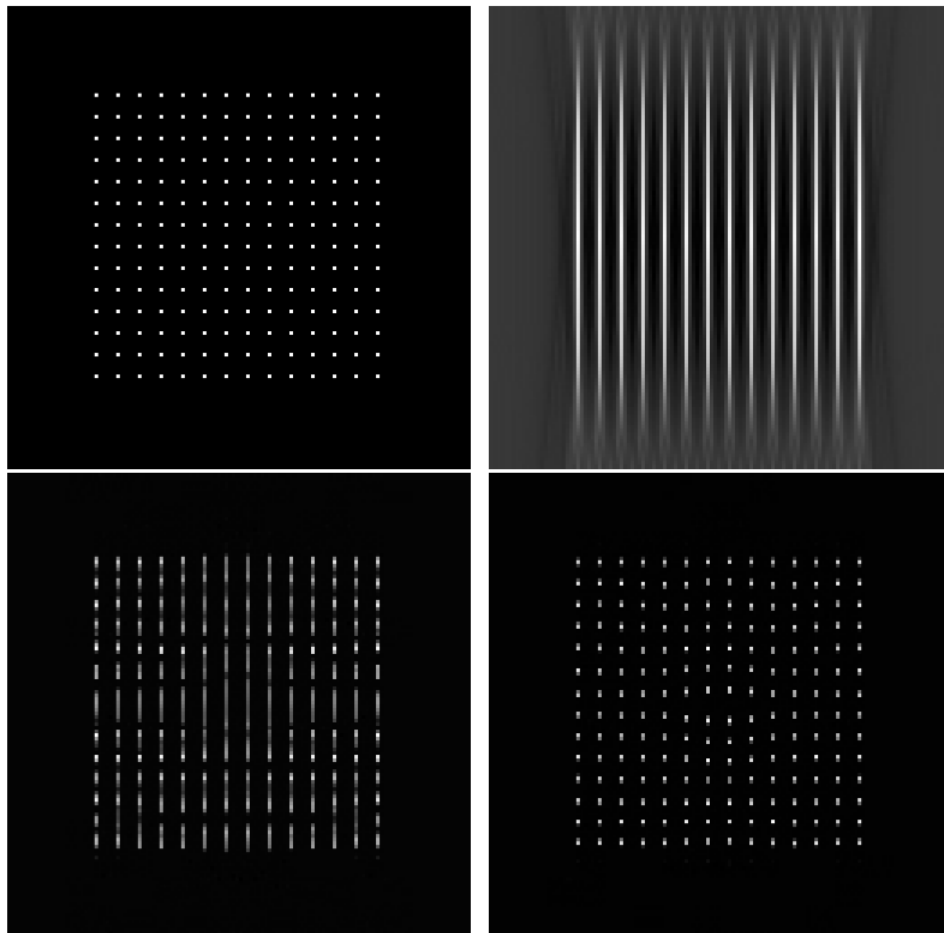


Fig. 1. *Upper left:* Original crystal lattice. *Upper right:* Reconstruction with filtered back projection from a $\pm 5^\circ$ tilt-series. *Lower left:* CS reconstruction enforcing sparsity. *Lower right:* CS reconstruction enforcing sparsity more efficiently. Note how the reconstruction is improved.