

Coherent x-ray diffraction microscopy: fundamental and technical limits

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In this paper we restate the basics of a coherent x-ray diffraction microscopy experiment with two goals in mind. The first is to allow the ultimate limits of the technique to be evaluated. We consider the limitation of imaging speed due to both currently-available and projected-future x-ray beam lines and the limitation of resolution due to radiation damage in the case of biological samples. The second goal is to determine the technical requirements for spatial and temporal coherence, x-ray wavelength, motion control and stability requirements etc that must be met if our future goals for resolution, statistical accuracy and 3D imaging speed are to be reached. This study is motivated in part by plans at the Advanced Light Source in Berkeley USA to build a new undulator and beam line for x-ray diffraction microscopy. In light of the fundamentals considered above we discuss the technical choices that we propose for the new diffraction microscopy facility.