

Diffraction microscopy - past, present and future

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The idea that the image of an object could be reconstructed from the recorded intensities of its diffraction pattern has been developed by David Sayre [1]. He has led the effort over the years to bring the idea to fruition. [2]. The Stony Brook group constructed an apparatus designed to collect the necessary data [3]. This apparatus is currently installed on an undulator beamline at the ALS. [4]. The Stony Brook group, in collaboration with the Cornell group, succeeded in the reconstruction of the diffraction pattern of a freeze-dried yeast cell [5], and is well on the way to extend this effort to three dimensional imaging, and to the reconstruction of frozen hydrated specimens. The same apparatus is being used by the Arizona State/Livermore/LBL group to image non-biological specimens [6].

A very interesting extension of this technique has been proposed by Spence et al., to collect the diffraction pattern from a stream of laser-aligned macromolecules, dubbed “serial crystallography” [7]. Beyond that, there are plans to mount an experimental program at the LCLS to reconstruct macromolecules from the diffraction patterns obtained using the XFEL beam. [8]

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