Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Diffraction by Distorted Object – a Unified Description of Coherent X-ray Diffraction and Imaging.[1] QUN SHEN, Argonne National Laboratory, XIANGHUI XIAO, Argonne National Laboratory — It is well-known that a diffracted or scattered wave by an object can be simply described by a Fourier transform of the electron density distribution of the object. This, in principle, is true only in the so-called far-field regime. In the near-field regime, evaluations of wave field amplitudes become more complicated and Fresnel diffraction and imaging effects have to be taken into account. In this paper, we present a unified diffraction theory that is valid in both far-field and near-field regime. Using the concept of a 'phase-chirped' distorted object, where Fresnel-zone construction is embedded on an original object, we show that the Fourier transform of this distorted object can be used to evaluate Fresnel coherent diffraction images or phase-contrast images from objects. This approach is valid continuously from the near-field to the far-field regimes. In addition, the distorted-object approach extends the applicability of Fourier-based iterative phasing algorithm that is already established for far-field diffraction into the near-field holographic regime where phase retrieval had been difficult in high-resolution structural imaging of noncrystalline specimens. Imaging in near-field also possesses the advantage that it can eliminate twin image ambiguity that may exist in far-field diffraction.

[1]Supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. W-31-109-Eng-38.

Qun Shen
Argonne National Laboratory

Date submitted: 30 Nov 2005 Electronic form version 1.4