Effect of Fresnel Illumination on Oversampling Iteration Method

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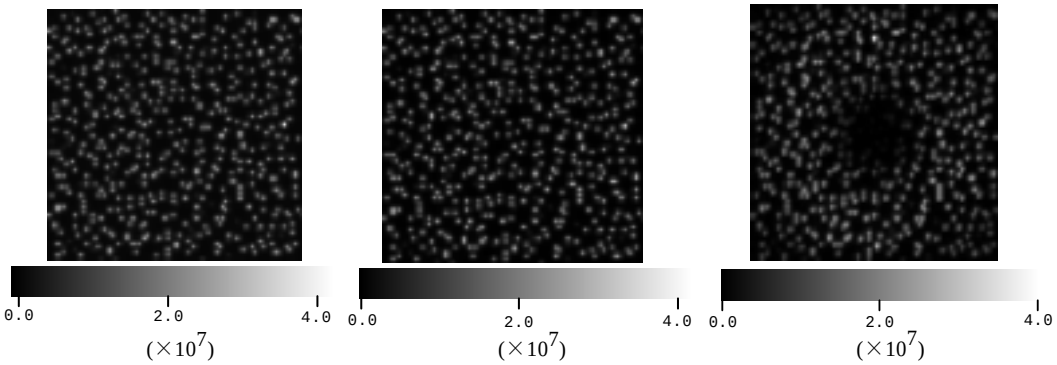
Coherent diffraction microscopy requires plane wave illumination on a specimen. In practice, a small pinhole or a focused beam is often used to reduce the illumination area, which unavoidably distorts the illumination wave. We quantitatively studied the effect of distorted illumination wave on phase retrieval by using computer simulations.[1] We have shown that various experimental conditions, such as the Fresnel number, pinhole size, alignment error and photon statistics, severely affect the quality of phase retrieval. As a specimen, silicon clusters in a random network structure was assumed, consisting of 2.821×10^{10} atoms. Figure.1 shows the assumed specimen and the results of the reconstruction for different Fresnel number (F_N) with the fixed pinhole radius of 25μm. The results will be of practical use for the design of coherent imaging experiments using the 3rd generation synchrotron radiation and future X-ray free electron lasers.



(a) (b) (c)

Fig.1 Silicon number distribution of (a) the model specimen, of the reconstructed image for (b) F_N =1 and (c) F_N =10. The sample size and the pixel size are $4.4\times4.4\mu m^2$ and 50 nm.

References

[1] Y.Kohmura, Y. Nishino, T. Ishikawa and J. Miao, in preparation