Improving spatial resolution of x-ray microscopy using direct demodulation method.

G. Li, Z.Y. Wu, M. Ando*, D.C. Xian

Beijing Synchrotron Radiation Facility, IHEP, CAS, Yuquan Road, P.O. Box 918, 2-7, Beijing 100049, China
**Photon Factory, IMSS, KEK, Oho 1-1, Tsukuba, Ibaraki 305-0801, Japan*

Any type of microscopy imaging (such as x-ray scanning microscopy, x-ray fluorescence microscopy, SNOM, SEM, STM, and AFM) can be expressed as the convolution process between the object to be investigated and the point-spread-function (PSF) of the imaging system. The spatial resolution is mainly determined by the PSF. Most efforts to improve the spatial resolution are focused on how to reduce it, such as using Fresnel Zone Plate or Kirkpatrick-Baez mirror with several nanometer resolutions. This way is common, and full of difficulties.

An alternative promising new approach is using the propriety deconvolution arithmetic to obtain higher resolution reconstructed image.

In this presentation, we will report the theory and experiment work on improving the spatial resolution of the oversampling microscopy image via the direct demodulation method, which is invented by astronomer, and solve the convolution equation under physical constraints. We can achieve the higher resolution (than the intrinsic resolution) reconstruction of complicated object from the oversampling data, and can greatly depress the influence of noise. Some examples will be discussed. Sub-nanometer spatial resolution of x-ray microscopy can be achieved via this methods.