

Diffraction imaging with coherent X-rays from SACLA and SPring-8

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Coherent X-rays are becoming more amenable to nano-scale imaging of weakly scattered objects. Recent operations of X-ray Free Electron Lasers (XFELs) as well as advanced synchrotron radiation sources have greatly facilitated structural investigations of specimens ranging from nanocrystals, biological cells, organelles, to macromolecular complexes. Various imaging modalities such as wet-CDI, single-shot 3D, pump-probe imaging, 3D tomography, etc, have been applied to better address the scientific issues of each systems, enriched by different characteristics from different types of light sources. We have employed coherent X-rays from SACLA and SPring-8 for imaging various specimens, and also demonstrated that the combined use of them enabled self-contained analysis of RNAi macromolecular complexes with applications not limited to. Those of our recent progresses on diffraction imaging will be introduced, and further issues related to the sample handling, signal-enhancement, etc., are discussed.

References

- [1] M. Gallagher-Jones, et al., "Macromolecular structures probed by combining single-shot free electron laser diffraction with synchrotron coherent x-ray imaging", *Nature Commun.* **5**:3798 (2014).
- [2] D. Nam, et al., "Imaging fully hydrated whole cells by coherent x-ray diffraction microscopy", *Phys. Rev. Lett.*, **110**:098103 (2013) ; T. Kimura, et al., "Imaging live cell in micro-liquid enclosure by x-ray laser diffraction", *Nature Commun.* **5**:3052(2014).
- [3] J. Park, et al., "Monte Carlo study for optimal conditions in single-shot imaging with femtosecond x-ray laser pulses", *Appl. Phys. Lett.*, **103**:264103(2013).
- [3] D. Nam, et al., "Fixed target single-shot imaging of nanostructures using thin solid membranes at SACLA", (submitted, 2015).