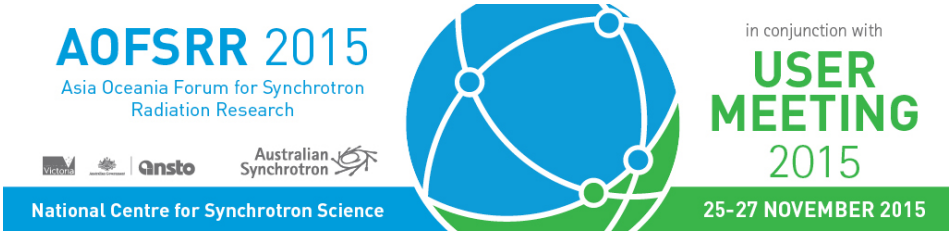

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Live cell nano-imaging free from radiation damage by using X-ray free-electron laser

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Coherent diffractive imaging (CDI) is a growing technique in photon science. In CDI, sample images are numerically reconstructed from the coherent diffraction data without the need for objective lenses. CDI is thus advantageous for X-rays, for which high-magnification objective lenses are difficult to fabricate. CDI has been demonstrated to be a powerful tool in visualizing cells and organelles using synchrotron radiation. Emerging X-ray free-electron lasers (XFELs) with femtosecond pulse durations further extends the ability of CDI to achieve spatial resolution beyond the conventional radiation-damage limitation.

We performed live cell nano-imaging using a Japanese XFEL facility, SACLA. We employed pulsed coherent X-ray solution scattering (PCXSS), a form of X-ray CDI, developed by our group [1,2]. A unique feature of PCXSS is to keep solution sample under a controlled environment in micro-liquid enclosure array (MLEA) chips. We succeeded in reconstructing a live cell image from a coherent diffraction pattern recorded with a single XFEL shot [2]. The reconstructed image quantitatively revealed the internal structures, *e.g.* high-image-intensity structure indicative of dense DNA. PCXSS can also be effectively applied to nano-imaging of materials functional in solution.

References:

[1] J. Pérez and Y. Nishino, Curr. Opin. Struct. Biol. 22, 670–678 (2012).

[2] T. Kimura *et al.*, Nature Commum. 5, 3052 (2014).

Keywords

XFEL, pulsed coherent X-ray solution scattering, CDI

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