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Adrian Mancuso - Structure determination and imaging at the European XFEL: First results and future opportunities

Thursday 6 December 2018 11:00 (30 minutes)

Serial crystallography at X-ray Free Electron Lasers (XFELs)1 has proven to be a valuable addition to the array of structure determination techniques presently available, particularly for time-resolved studies involving either photo-sensitive systems2,3, radiation damage sensitive sample4 or potentially for systems involving the mixing of substrate with a system under study5. The European X-ray Free Electron Laser6 (EuXFEL) presents a new and expanded capability to perform serial crystallography and single particle imaging experiments. This is not just because additional XFEL sources create a higher availability of experimental time, but also because the European XFEL offers the highest repetition rate of XFEL pulses of all XFELs with orders more pulses per unit time.
In this presentation I will outline the experimental capabilities of the Single Particles, Clusters and Biomolecules and Serial Femtosecond Crystallography (SPB/SFX) instrument7 of the EuXFEL, an instrument designed to predominantly support structural biology applications. I will show a selection of results from the first experiments at the EuXFEL which demonstrate that we can successfully exploit the Megahertz repetition rate of EuXFEL for both serial crystallography8,9 and for single particle imaging. Finally, I'll give an outlook to future experiments that may be performed at the SPB/SFX instrument.

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3. Tenboer, J. et al. Time-resolved serial crystallography captures high-resolution intermediates of photoactive yellow protein. Science 346, 1242–1246 (2014).
4. Suga, M. et al. Native structure of photosystem II at 1.95 Å resolution viewed by femtosecond X-ray pulses. Nature 517, 99–103 (2014).
5. Schmidt, M. Mix and Inject: Reaction Initiation by Diffusion for Time-Resolved Macromolecular Crystallography. Advances in Condensed Matter Physics 2013, 1–10 (2013).
6. Tschentscher, T. et al. Photon Beam Transport and Scientific Instruments at the European XFEL. Applied Sciences 7, 592–35 (2017).
7. Mancuso, A. P., Reimers, N., Borchers, G., Aquila, A. & Giewekemeyer, K. Technical design report: Scientific instrument Single Particles, Clusters, and Biomolecules (SPB). (European XFEL, 2013).
8. Wiedorn, M., Oberthuer, D., et al, Nature Communications, accepted.
9. Grünbein, M., et al, Nature Communications, 9, 3487 (2018).

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