Poster Presentation

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X-ray Emission spectroscopy within the AXSIS project

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The AXSIS project, which is currently hosted by CFEL (DESY), is devoted to studying the water oxidation reaction in the native Photosystem II (PSII) complex by time-resolved attosecond X-ray crystallography in combination with X-ray emission (XES), X-ray absorption (XAS) and 2D optical spectroscopies. The combination of these techniques will give an unprecedented insight not only into the structure of PSII, but also into the dynamics that leads to the conversion from light to chemical energy. A high-resolution, multicrystal energy-dispersive XES spectrometer, based on the von Hamos geometry, will be specially designed to collect Mn XES spectra of PSII.
Oxygenic photosynthesis sustains all higher life on earth by converting light energy from the sun into chemical energy. PSII is a nano solar-energy converter that captures the light from the sun to catalyse light-driven electron transport across the photosynthetic membrane. It provides the electrons for the photosynthetic electron transport chain by the water splitting process in the oxygen-evolving complex (OEC), where it extracts in 4 sequential charge separation steps 4 electrons from water releasing 4 protons and oxygen [1-3]. PSII is the only system in nature capable of forming molecular oxygen from water and sunlight. In spite of all the advances, water oxidation by the OEC is still not entirely understood and several models for the mechanism of oxygen evolution in PSII have been proposed to account for the detailed oxygen evolution by PSII. XAS/XES and optical spectroscopy measurements simultaneous to the attosecond X-ray crystallography experiment will help to reveal the oxidation state of the Mn atoms in the OEC cluster as well as provide information about the dynamics of light absorption and excitation energy transfer within PSII. This work covers the implementation of the XAS/XES techniques within the AXSIS project and shows how the results of the project will contribute to the global understanding of how the OEC operates.

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