

NANOSCIENCE COLLOQUIUM

Exploring Ultrafast Electronic and Structural Dynamics of Heme Proteins through X-ray Spectroscopy Techniques at X-ray Free Electron Lasers

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Abstract:

The emergence of X-ray Free Electron Lasers (XFELs) has potentialized the study of ultrafast phenomena in the X-ray range, offering high temporal resolution and unprecedented peak brightness. This technology has not only extended the capabilities of established methods into the time domain but has also spurred the development of novel, photon-hungry techniques. XFELs enable the exploitation of the element and site-specificity inherent in X-ray spectroscopy techniques, such as X-ray Absorption (XAS) and X-ray emission (XES), for investigating ultrafast (sub-100 fs) processes in complex molecular systems, including dilute proteins under physiological conditions. The complete relaxation pathways and timescales of photoinduced proteins can be extracted from a combination of X-ray techniques that are fully complementary to optical spectroscopy measurements. In this talk, I will show how this was used to unveil the photoinduced dynamics of heme proteins, such as Cytochrome C and Myoglobin, by following the initial electronic excitation and subsequent structural reorganization, as well as present future perspectives in the field of ultrafast X-ray spectroscopy at Free Electron Lasers, and more specifically at SwissFEL.

