# Ultrafast electron dynamics in real world light activated complexes studied by x-ray spectroscopy.

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With the recent advances in the development, performance and availability of ultra-short x-rays pulses it has become possible to use element selective spectroscopy as a regular tool in sample characterization. In the field of light sensitization and light activated catalysts these tools are increasingly used to study model complexes and learn the principles behind the observed dynamics. Understanding these principles in turn has led to the development of extraordinary new complexes capable of harvesting and using solar energy. During the recent years the experimental conditions have been improved and now allow the study of samples that are active as catalysts and/or drive light harvesting in dye sensitized solar cells. We will show two examples in which we used x-ray spectroscopy to understand the light induced dynamics in complex molecular systems. The first system an iron carbene sensitizers which now allow the construction of dye sensitized solar cells based on earth abundant materials. [1, 4, 6] We will discuss how we studied the electronic and vibrational dynamics in these complexes with x-ray emission spectroscopy and why the hot electron dynamics we discovered of is of such an import in the design of future light sensitizing complexes of all kinds. The second story is focused on the dynamics at the catalytic reaction center of a well-functioning light activated hydrogen evolving Ru-Pt catalyst. We studied the dynamics of the electron transfer between light sensitizing moeity and the reaction center. We found beside the expected electron transfer clear evidence for a chemical reactions triggered by light that consumed two electrons after the activation with a single absorbed photon and thus a potential pathway to avoid the usual requirement of multi photon processes for hydrogenase in molecular systems.[3]
Lastely we will discuss why we see sources with 100ps temporal resolution as such important tools for the development of novel light harvesting complexes, how we plan to use the novel capabilities at the ESRF and what we see as some of the most important parameter that will lead to its success.[2, 5]

**References**

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