

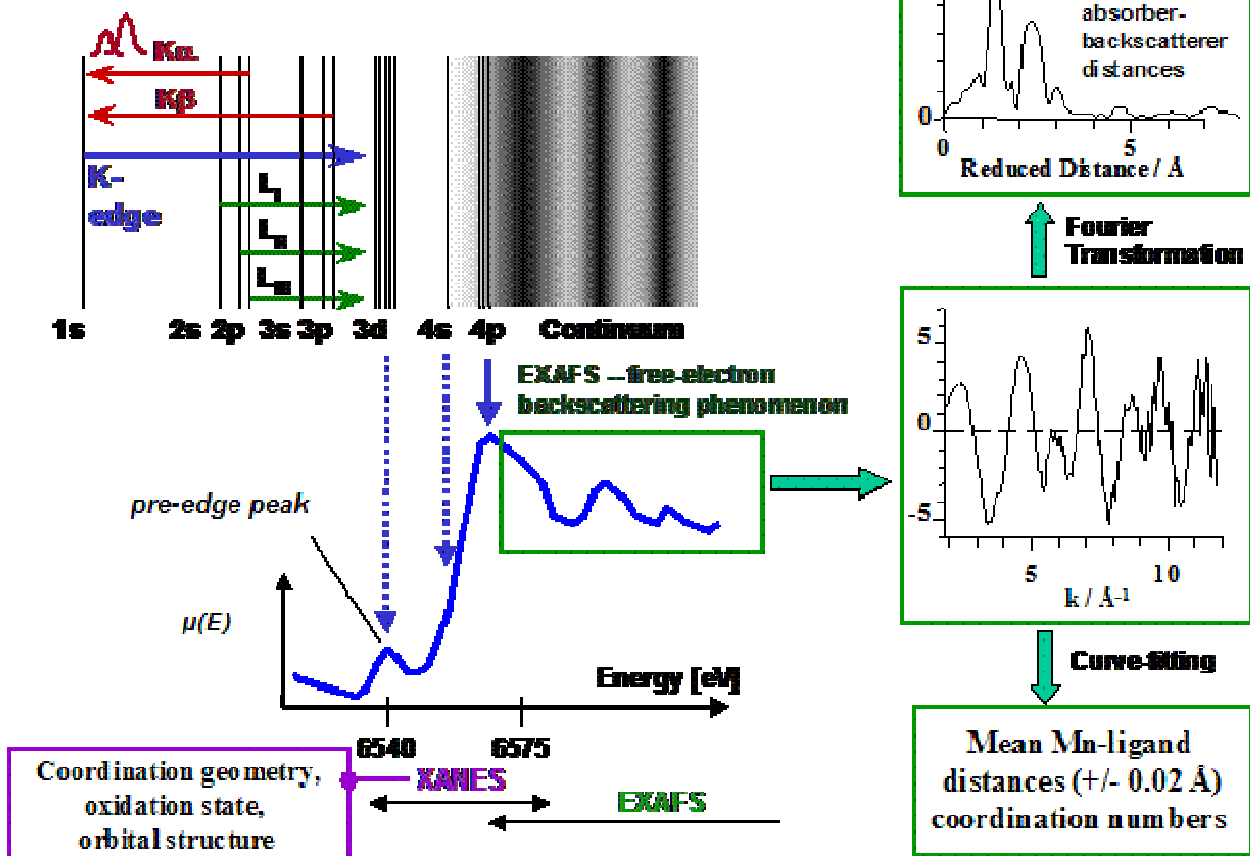
## Techniques and methodical developments

We are working as a team of physicists, chemists, and biologists. The spectrum of employed methods ranges from experimental biophysics and theoretical chemistry to biochemistry and physiology. An important educational aim is to allow insights into specific methods and concepts of each discipline to every Ph.D.-student working in our group.

The following methods are employed:

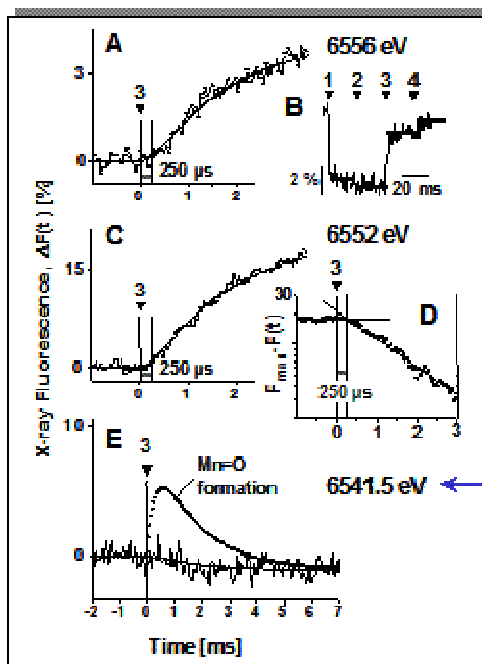
- X-ray absorption spectroscopy using synchrotron radiation (XANES and EXAFS, RIXS, linear-dichroism measurements, time-resolved experiments; performed at the BESSY in Berlin, DESY in Hamburg and at the ESRF in Grenoble)
- electron paramagnetic resonance (EPR) at liquid helium temperatures; FTIR spectroscopy
- optical spectroscopy (UV/VIS, fluorescence, time-resolved measurements)
- photoacoustic and photothermal measurements (time-resolved calorimetry)
- purification and biochemical characterization of (photosynthetic) membrane proteins
- preparation of layered protein-membrane particles (for linear-dichroism spectroscopy)
- development of theory and software for evaluation of XAS data, advanced simulations of XANES spectra
- molecular modeling and analysis of complex reaction kinetics
- preparation of protein biosensors (for the detection of toxic substances in the environment)
- various fluorimetical procedures (chlorophyll fluorescence, development of methods for ecosystem research, biotests and biosensors)

### X-ray Absorption Spectroscopy (XAS) at Mn K-edge

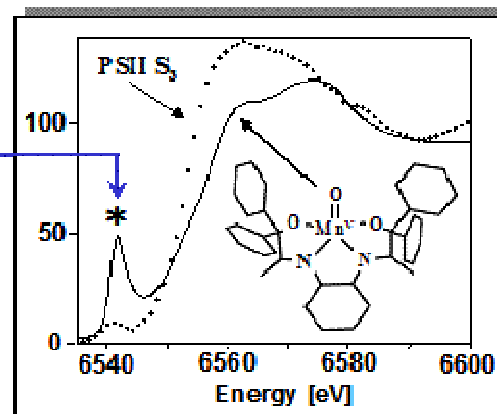


# Intermediate formation tracked by a time-resolved X-ray experiment

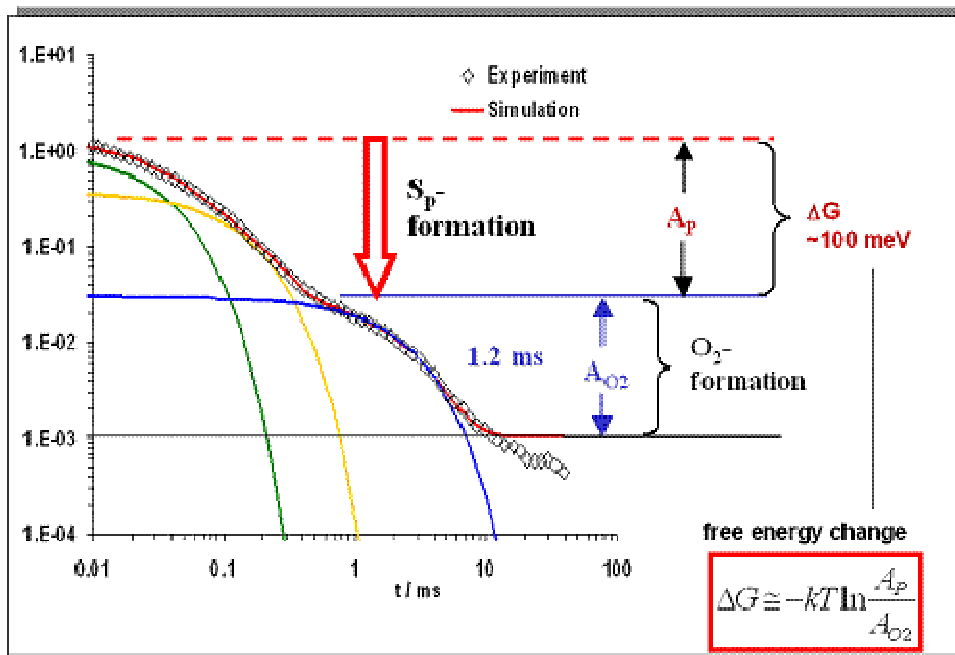
- Step towards time-resolved structural biology at  $\mu\text{s}$  resolution by BioXAS -



Tracking S-state transitions of PSII by a time-resolved XAS measurements  
(Hummel et al., Science, 2005)



Delayed Chlorophyll fluorescence => Energetics of PSII  
 Decay curve after third Laser flash ( $S_3 \Rightarrow S_4 \rightarrow S_0$ )



Characterization / Hypothesis on novel intermediate  
 (Haumann et al., Science 2005)

