Joint LLC Seminar

Friday March 31st, 15:15
Sal A (L317), Dep. of Physics

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Probing performance and regulation of photosynthesis in vivo. From picoseconds to hours

Photosynthetic organisms are crucial for life on Earth as they provide food and oxygen and are at the basis of most energy resources. They have a large variety of light-harvesting strategies that allow them to live nearly everywhere where sunlight can penetrate. They have adapted their pigmentation to the spectral composition of light in their habitat, they acclimate to slowly varying light intensities and they rapidly respond to fast changes in light quality and quantity. These regulatory processes are particularly important for oxygen-producing organisms because an overdose of light in combination with oxygen can be lethal [1]. The study of light harvesting and its regulation is not only a fascinating research field in itself, it will hopefully also provide the knowledge that is required for optimizing light harvesting in algae and plants to improve light-driven production processes.

Cryo-electron microscopy has recently started to create golden times for structural biologists and in the field of photosynthesis this has revealed the structure of so-called supercomplexes of photosystems I and II at near-atomic resolution, which can be even larger than 1 MDa. These structures lie at the basis of the light-harvesting reactions in photosynthesis but without the results of numerous advanced spectroscopic studies these structures would be useless and it is the combination of structural studies and functional spectroscopy that significantly contribute to the understanding the primary processes in photosynthesis [2] and this will be illustrated with several examples.

Now that we have so much structural and spectroscopic knowledge about purified and isolated (super-) complexes it is important to study the (ultra)fast light reactions *in vivo*. This has recently revealed important differences in the light-harvesting process and its regulation as compared to previously obtained *in vitro* results on isolated photosynthetic complexes and membranes. For these *in vivo* studies combining spectroscopy methods for molecular and functional information can be combined with microscopy methods for submicron structural and structural dynamics information. Several examples will be given of recently studied regulatory processes of light harvesting *in vivo* and how they can differ at the molecular and cellular level in different organisms. Finally, several new directions for future biophysical research for the study of photosynthesis will be proposed.

[1] R. Croce, H. van Amerongen, *Nature Chem. Biol.* **10**, 492-501 (2014).
[2] R. Croce, H. van Amerongen H *Science* 369: eaay2058 (2020)

Sal A (L317) is located at the Department of Physics, Professorsgatan 1

Coffee and refreshments will be served before the seminar, from 15:00

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