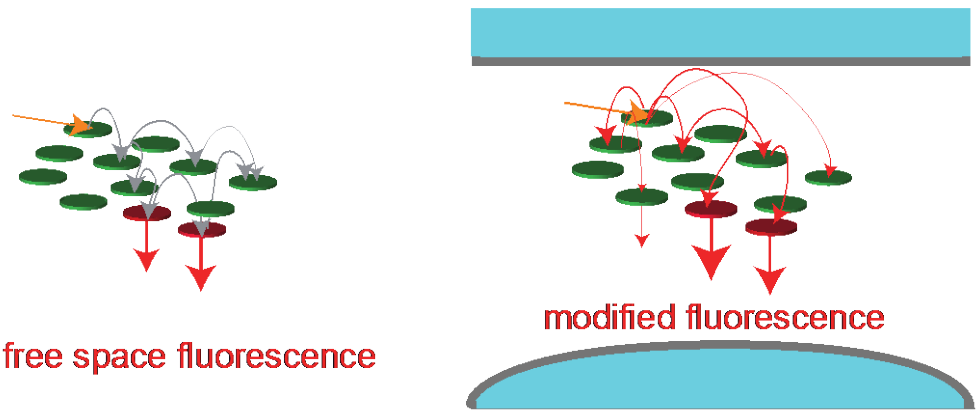
Tuning the optical properties of Photosystem I with subwavelength microcavities and plasmonic nanoparticles

M. Brecht[1,2]

[1] *Universität Tübingen, IPTC und Lisa + Center, Auf der Morgenstelle 18, 72076 Tübingen, Germany*

[2] *Hochschule Reutlingen, Angewandte Chemie, Alteburgstrasse 150, 72762 Reutlingen, Germany*

In my talk I will show low temperature single-molecule fluorescence experiments on Photosystem I (PS I). The emission spectra of single PS I complexes are a result of several contributions and not only of one lowest trap [1,2]. At low temperature (1.4 K) changes of the fluorescence emission during time are still observed like line hopping or line broadening. Those effects are due to small conformational changes, e.g. proton fluctuations, within the binding site of the pigments (spectral diffusion) [2]. If the spectral diffusion rate is low, narrow emission lines, so called zero-phonon lines (ZPL), can be observed in the emission spectra. Then, the polarisation and electron-phonon coupling of these emitters can be determined with high precision.



In addition, we try to control the fluorescence and energy transfer properties of PS I with optical subwavelength microcavities or plasmonic nanoparticles [3,4,5]. The mode structure around PS I affects the energy transfer properties and, as a consequence, the fluorescence emission. This effect allows us to selectively enhance or suppress energy transfer pathways. We are able to show how the excitation transfer within PS I is affected by external fields. The ability to control the energy transfer within such efficient energy converters like PS I enables us to predict the efficiency of PS I if they are close to plasmonic structures. Such hybrid systems were proposed to enhance PS I function in bio-solar applications [6].

[1] M. Brecht, V. Radics, J. Nieder, R. Bittl, PNAS (2009) 106, 11857-11861
[2] M. Brecht, H. Studier, V. Radics, R. Bittl, JACS (2008) 130, 17487-17493
[3] A. Konrad, A-L. Trost, S. Skandary, M. Hussels, AJ. Meixner, NV. Karapetyan, M. Brecht, PCCP, (2014), 16,6175-6181
[4] J. Nieder, R. Bittl, M. Brecht, Angewandte Chemie Int.-Ed. (2010) 52, 10415-10418
[5] I. Ashraf, A. Konrad, H. Lokstein, S. Skandary, M. Metzger, J. Djouda, T. Maurer, PM. Adam, AJ Meixner, M. Brecht, Nanoscale (2017) *revision submitted*
[6] I. Carmelli, I. Liebermann, L. Kravesrsky, Z. Fan, A.O. Govorov, G. Markovich, S. Richter, Nano Lett. (2010) 10, 2069-2047