Karl Friedrich Bonhoeffer Lecture

Thursday, 22nd March 2012 - 5 pm

Manfred Eigen Lecture Hall
Max Planck Institute
for Biophysical Chemistry
Am Fassberg 11, 37077 Göttingen

Prof. John C. H. Spence

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"X-ray lasers for structural biology and molecular movies"

I will review our* recent experiments with the first hard X-ray laser at SLAC near Stanford, the LCLS. These have included snap-shot imaging from membrane protein nanocrystals and viruses, and the first pump-probe experiments on Photosystem I-ferredoxin using a liquid jet sample-delivery system of novel design. Our aim is to record movies of molecular machines at work, using femtosecond X-ray pulses so brief that they terminate before radiation damage commences. New phasing methods for membrane protein nanocrystals and the extraction of structure factors by our Monte-Carlo method will be reviewed. Recent work using angular correlation functions to recover molecular images from the correlated fluctuations in snap-shot diffraction patterns from many randomly-oriented molecules in solution will also be outlined. The prospects for dynamic snap-shot chemical imaging using mixing jets will also be described, and a new method based on the Kapitza-Dirac effect which uses a laser as a Zernike phase plate for cryo-electron microscopy. Finally, we consider the prospects for using fast electron beam pulses in more compact, inexpensive apparatus, instead of X-rays, for molecular movies.

*Chapman et al., Nature 470, 73-77 (2011). Spence et al., Rep. Prog. Phys. (2012). Fromme and Spence, Curr. Opin. Struct. Biol. 21, 509-516 (2011).

Host: Simone Techert