

Prague, May 6, 2014

Jakub Dostál started to work on his Ph.D. project in the year 2009. The initial intention was to continue in the research oriented towards the dye sensitized solar cells based on pigments from green photosynthetic bacteria, which was the topic of his diploma work. However, shortly after begging of Jakub's Ph.D. study, an opportunity occurred to utilize the 2D electron coherent spectroscopy for a study of light-harvesting processes in green bacteria. The 2D spectroscopy is a modern technique of an optical spectroscopy enabling to measure simultaneously with a high time and spectral resolution. The technique is not available in the Czech Republic, and the project was based on a combination of the excellent experimental equipment of the lab of Dr. Donatas Zigmantas, Lund University, Sweden, who is a world-recognized expert in the field of the 2D spectroscopy, and long-standing experience with the study of excitation energy transfer processes in green bacteria at the department of Chemical Physics and Optics in Prague. Since the year 2010 Jakub therefore started a joint Ph.D. study between Charles University in Prague and Lund University.

Jakub quickly become familiar with the 2D spectroscopy, which is in my opinion the most advanced optical spectroscopy technique at the present. It allows to obtain much more complex information than the classical pump-probe spectroscopy. However, this advantage is balanced by a demanding experimental set-up and sometimes difficult interpretation of the acquired data. The successful utilization of the method thus requires not only experimental skills, but also a rather deep understanding of the theory behind the experiments. Jakub has mastered all of that.

His effort led to the thesis consisting of five papers, four of them already published in prestigious journals, and one manuscript in preparation. Jakub is the first author of four of them and a second author of the remaining one. He is also a coauthor of two other published papers not included in the thesis. In addition, Jakub attended several international conferences where he presented his results, often in oral presentations.

The papers included in the thesis cover different aspects of light-harvesting in green bacteria. Each of them provides an original and important contribution to the field and employs advantages of the 2D spectroscopy. High temporal resolution of the method enabled to resolve and interpret a sub-100 fs excitation diffusion process in the chlorosomes which was not observed before (paper I). The 2D spectroscopy is especially well suited for the study of coherences in various systems, and this topic is covered in papers II and III. The ability of the method to distinguish between non-interacting and interacting pigments allowed to resolve for the first time the excitonic structure of the chlorosome baseplate (paper IV). The very short pulses used in the 2D spectroscopy cover a large spectral region, which enabled to study the excitation flow in the complete photosynthetic machinery of green photosynthetic bacteria inside their cells (paper V).

The thesis is written in good and clear English. Except the excellent research part of the thesis I especially appreciate the part describing the principles of the 2D spectroscopy, which is written in a comprehensible way understandable even to non-experts, and therefore may certainly serve as the first reading for students new to the field of the 2D spectroscopy.

In summary, Jakub has proven to be able of independent scientific work on a very high level. I strongly recommend Jakub Dostál for the award of the Ph.D. degree.

Jakub Pšenčík