Femtosecond and picosecond excitation dynamics in FCP complexes: results from 2D spectroscopy and streak-camera measurements

Andrius Gelzinis, Jevgenij Chmeliov, and Leonas Valkunas*

Institute of Chemical Physics, Faculty of Physics,

Vilnius University, Vilnius, Lithuania and

Department of Molecular Compound Physics,

Center for Physical Sciences, Vilnius, Lithuania

Marijonas Tutkus, Ernesta Vitulskienė, and Marius Franckevičius

Department of Molecular Compound Physics,

Center for Physical Sciences, Vilnius, Lithuania

Claudia Büchel

Institute of Molecular Biosciences, Goethe University Frankfurt, Frankfurt, Germany

Bruno Robert

Université Paris-Saclay, CEA, CNRS,

Institute for Integrative Biology of the Cell (I2BC), Gif-sur-Yvette, France

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* leonas.valkunas@ff.vu.lt

Diatoms constitute a major group of algae, that is responsible for a significant part of the global primary production on Earth. Their adaptation to aqueous environment is due to their major light-harvesting complex—the fucoxanthin–chlorophyll protein (FCP) complex. In 2019 the atomic resolution molecular structures of several FCP complexes were obtained: first, an FCP dimer from the pennate diatom *Phaeodactylum tricornutum* was resolved by crystallography [1], second, the structure of the PSII–FCP supercomplex from the centric diatom *Chaetoceros gracilis* was obtained by electron microscopy [2, 3]. Recently, we evaluated if these available FCP structures are consistent with the previously obtained 2D spectroscopy results on FCP from another centric diatom *Cyclotella meneghiniana* and found that the published FCP structures are somewhat at odds with a few observations obtained from the ultrafast spectroscopy. We proposed a trimer-based FCP model for *Cyclotella meneghiniana*, that is consistent with experimental data [4].

We have also made streak-camera time-resolved fluorescence (FL) measurements on FCPs from *Cyclotella meneghiniana* [5]. Our results demonstrate significant changes in the FL spectra and kinetics upon aggregation of FCP – the FL kinetics become quenched and a red shoulder appears in the FL spectra. Interestingly, the obtained results are qualitatively similar to those from LHCII from higher plants and can be explained in terms of two fluorescing species, with their spectra being dependent on temperature.

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[1] W. Wang et al., Science **363**, 6427 (2019).

[2] Pi et al., Science **365**, 6452 (2019).

[3] Nagao et al., Nat. Plants. **5**, 890 (2019).

[4] Gelzinis et al., Phys.Chem.Chem.Phys. **23**, 806 (2021).

[5] Gelzinis et al., manuscript in preparation (2023).