

REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

Faculty of Science
University of South Bohemia in České Budějovice
Branišovská 1645/31a
370 05 České Budějovice, Czech Republic

2. Type of research institution: Public university (veřejná vysoká škola)

3. Head of the institution: prof. PhDr. Bohumil Jiroušek, Dr. – rector

4. Contact information of designated person(s) for applicants:

Tomáš Polívka – professor of biophysics
tpolivka@jcu.cz, +420 387 776 259
Department of Physics, Faculty of Science, University of South Bohemia
Branišovská 1760, 37005 České Budějovice, Czech Republic

5. Research discipline in which the strong international position of the institution ensures establishing a Dioscuri Centre:

Natural Sciences and Technology: *Physical and analytical chemical sciences* - physical chemistry/chemical physics, theoretical chemistry, analytical chemistry, inorganic chemistry, organic chemistry, method development

6. Description of important research achievements from the selected discipline from the last 5 years including a list of the most important publications, patents, or other results:

The Polívka group focuses on ultrafast spectroscopy of natural pigments and pigment-protein complexes. We study energy transfer processes as well as the photoprotective mechanisms in photosynthetic organisms and we develop new experimental approaches employing ultrafast spectroscopy. We have developed multi-pulse (pump-dump-probe) transient absorption setup that has been used to reveal otherwise hidden excited-state dynamics (a) or two-photon excitation transient absorption setup (f). In the past years, our major achievements are associated with identification of photoprotective mechanisms involving carotenoids (d,f,g) as well as studies of specific pigments and pigment-protein complexes involved in photoprotection (c,e) or mechanisms of heat dissipation at molecular level (b).

- West, R.G., Bína, D., Fuciman, M., Kuznetsova, V., Litvín, R., Polívka, T. Ultrafast multi-pulse transient absorption spectroscopy of fucoxanthin chlorophyll a protein from *Phaeodactylum tricornutum*. *BBA-Bioenergetics*, 1859, 357-365, 2018.
- Balevičius, V., Wei, T., Di Tommaso, D., Abramavicius, D., Hauer, J., Polívka, T., Duffy, C. The full dynamics of energy relaxation in large organic molecules: from photo-excitation to solvent heating. *Chemical Science*, 10, 4792-4804, 2019.
- Khan, T., Dominguez-Martin, M.A., Šímová, I., Fuciman, M., Kerfeld, C.A., Polívka, T. Excited state properties of canthaxanthin in cyanobacterial carotenoid-binding proteins HCP2 and HCP3. *J. Phys. Chem. B*, 124, 4896-4905, 2020.
- Saccon, F., Durchan, M., Bína, D., Duffy, C.D.P., Ruban, A.V., Polívka, T. A protein environment-modulated energy dissipation channel in LHCII antenna complex. *iScience*, 23, 101430, 2020.
- Khan, T., Litvín, R., Šebelík, V., Polívka, T. Excited state evolution of keto-carotenoids after excess energy excitation in the UV region. *ChemPhysChem*. 22, 471-480, 2021.
- Šebelík, V., Kuznetsova, V., Lokstein, H., Polívka, T. Transient absorption of chlorophylls and carotenoids after two-photon excitation of LHCII. *J. Phys. Chem. Lett.* 12, 3176-3181, 2021.
- Skotnicová, P., Staleva-Musto, H., Kuznetsova, V., Bína, D., Konert, M.M., Lu, S., Polívka, T., Sobotka, R. Plant LHC-like proteins show robust folding and static non-photochemical quenching. *Nat. Comm.*, 12, 6890, 2021.

7. List of no more than 3 important research projects in the selected discipline awarded in national and international calls to the institution in the last 5 years:

2016-2018, Carotenoids in light-harvesting and photoprotection – new approaches using multipulse femtosecond spectroscopy

Tomas Polivka

Czech Science Foundation

8 655 000 CZK

2018-2020, Ultrafast spectroscopy as a tool for elucidation the structure-function relationship in cyanobacterial carotenoid-binding proteins

Tomas Polivka

Cech Science Foundation

4 259 000 CZK

2019-2023, Relation between structure and function of carotenoids: New pathways to answer unresolved questions

Tomas Polivka

Czech Science Foundation

26 818 000 CZK

8. Description of the available laboratory and office space for a Dioscuri Centre:

The departments involved in this project (Physics and Chemistry) will provide standard office space for a Dioscuri centre, which includes office space for PI + up to three other group members, further extension may be negotiated. All current lab space and equipment at the departments will be available for Dioscuri Centre. Building a completely new lab for the Dioscuri Centre could be negotiated, availability of the new lab depends on the lab type and actual situation at the departments/institute.

9. List of the available research equipment for a Dioscuri Centre:

Femtosecond amplified system (Spectra Physics; MaiTai, Empower and Spitfire Ace) operating at 1 kHz repetition rate with a 100 fs output at 800 nm divided into four independent beamlines that all can operate simultaneously.

Three parametric amplifiers (TOPAS, TOPAS Prime, and a home-built NOPA) enable to tune output across a broad range of wavelengths (250-2500 nm).

Three high-stability motorized and computer-controlled delay lines, allowing proper timing between excitation and probe pulses in the 5 fs to 12 ns time range.

Multifunctional detection system equipped with a double CCD detector allows for direct utilization of the system either in the pump-probe or pump-dump-probe excitation modes in the 350-1200 nm spectral range.

Time correlated single photon counting setup PicoQuant FT300 with a selection of diode lasers to excite at various wavelengths. Detection of fluorescence of liquid samples, surfaces of solid samples and liquid samples at low temperature (77K) is possible in the range of 350 – 850 nm with time resolution down to 40 ps.

For measurements at temperatures different from room temperature, a temperature-controlled sample holder for varying the sample temperature from -10 to 80°C as well as a liquid nitrogen cryostat are available.

Jasco J-715 spectropolarimeter for CD measurements, Fluorolog-2 spectrofluorometer and absorption spectrometer are available for basic characterization of optical properties of the samples.

Electrochemical analyser enabling to run cyclic voltammetry and bulk electrolysis equipped with spectroelectrochemical cell allowing to use it in optical experiments.

Cryo-electron microscopy

Bioanalytical laboratory with several GC and HPLC/MS, proteomic MS equipment

Laboratory equipment for standard biochemical and molecular biology research, protein expression, isolation and characterisation, dark and cold rooms for special research conditions, bacteria and algae cultivation facility.

10. List of the additional benefits (other than listed in the conditions for hosting a DC, see invitation) that the Institution declares to provide for a Dioscuri Centre (i.e.: additional funds, personal benefits, dual career options, relocation support or other):

The host institution is located in a shared campus with Biology Centre of the Academy of Sciences, a leading institution in biology research in the Czech Republic. Several shared infrastructures are of high benefit of close collaboration within the campus, such as Electron microscopy facility or metabolomic centre.

The host institution has also very close collaboration with the Johannes Kepler University in Linz, Austria, both institutions run joint Cooperative Regional Research Infrastructure for Molecular Science and Technology (RERI) that includes NMR centre for structural biology.

11. Other information about the internationalization of the research institution, international researchers employed at the institution, the availability of English language seminars etc.:

The host institution organises a joint degree bachelor and master study programs in Biological Chemistry together with Johannes Kepler University in Linz, Austria, taught entirely in English.