

Project 3.6 Photoswitching under dual confinement: a new strategy for the light regulation of functional host-guest systems

Supervisor: Volodymyr Sashuk, PhD Dsc.

Institute: Physical Chemistry PAS

Research group: Research group No. 7. Chemistry in Confined Spaces – dr hab. Volodymyr Sashuk

www: <http://groups.ichf.edu.pl/sashuk>

Background:

Light-sensitive molecules, capable of photoswitching, have garnered considerable interest due to their potential applications in active materials, sensors, and energy conversion. In nature, microorganisms and animals harness light energy by utilizing retinal confined within the hydrophobic pocket of opsin proteins. This natural photoswitch undergoes trans to cis isomerization, resulting in significant conformational changes that are subsequently transduced into a chemical or electrical signal.

Scientists have long applied a similar principle to devise artificial functional systems. However, the use of synthetic photoswitches and protein-mimicking voids is often hindered due to poor matching between them. The limited number of man-made molecules makes it challenging to select a supramolecular pair that efficiently responds to photoisomerization.

To address this issue, we propose an innovative strategy of 'dual confinement'. Its essence lies in the utilization of, alongside intramolecular cavities, interligand spaces that can be found on the surfaces of metal nanoparticles. It is anticipated that their interplay will have a substantial impact on light-induced processes.

Aim:

Our objective is to fully comprehend and precisely manipulate the nano-, supra-, and molecular factors governing photoswitching within 'dually confined' spaces. Furthermore, with the knowledge gained, we aim to develop novel, efficient systems exhibiting adaptive behavior in the realm of molecular recognition and catalysis.

Requirements:

- master's degree in chemistry, physics, or related disciplines;
- experience in organic synthesis and practical knowledge of spectroscopy, thermodynamics, and chemical kinetics;
- proficiency in spoken and written English;
- scientific accomplishments and skills in molecular modeling and computer graphics are welcome