

# New Horizons Solvay Lectures



## Professor Rafal Klajn

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### BIO:

Rafal Klajn was born in Poland in 1982. In 2009 he completed his PhD in Chemical and Biological Engineering at Northwestern University (USA). The thesis was dedicated to the development of new functional materials arising from the integration of inorganic nanocrystals with molecular and supramolecular switches. Since 2009, Rafal Klajn is faculty member of the department of Organic Chemistry of the Weizmann Institute of Science, first as assistant professor and since 2016 as associate professor. Rafal Klajn is author of more than 50 publications and is recipient of the 2010 IUPAC Prize for Young Chemists, the 2013 ACS Victor K. LaMer Award, a 2013 ERC Starting Investigator Award, and the 2015 Liebig Lectureship (Germany), among other prizes.

### *Chemistry in confined spaces: Light-controlled reactions in the cavities of metal-organic cages*

ABSTRACT: Nature has long inspired chemists with its ability to stabilize ephemeral chemical species [1], perform chemical reactions at unprecedented rates [2] and selectivities [3], and synthesize complex molecules [4] and inorganic nanostructures [5] with seemingly effortless ease. However, chemists and natural systems perform reactions in fundamentally different ways: whereas chemists typically carry out reactions between molecules moving around freely in solution, natural systems consistently use the effect of nanoscale confinement. During the past several years, our group has been engaged in studying chemical reactivities in various types of confined spaces, including nanopores of porous aromatic frameworks (PAFs) [6], cavities of bowl-shaped inorganic nanoparticles [7], and dynamically self-assembling nanoflasks [8]. To efficiently guide many key processes in nature, however, confined spaces have to be sufficiently flexible [9]. In synthetic systems, this flexibility aspect is critical for, e.g., efficiently operating single-molecule switches, whose isomerization is often accompanied by significant conformational changes. To this end, we investigated photoisomerization in several classes of light-switchable molecules confined within flexible metal-organic cages. Working with spiropyran switches, we found that the cage had a propensity to stabilize the otherwise unstable, open form of the switch. I will describe how this blue-colored form could be photoisomerized using – counterintuitively – using blue light. These results constitute the first example of negative photochromism of spiropyran in a nonpolar environment [10]. Next, I will discuss encapsulation and switching of several azobenzene derivatives under confinement, focusing on the unexpected finding of light-controlled azobenzene trafficking between different cages [11]. The talk will be concluded by the results of our recent studies on light-induced dimerization of confined anthracenes [12], from which we concluded that these reactions obey the topochemical rules set half a century ago by Gerhard Schmidt [13].

**Wednesday 27 March 2019 at 4.00 P.M.**

**Drinks will be served at 5:00 p.m. in front of the Solvay Room**

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