From Probing to Transforming: Chemistry and X-rays in Liquid Phase

Petr Slavíček

Department of Physical Chemistry
University of Chemistry and Technology

10:00 am, Thursday November 30th 2017

J.Heyrovsky Institute

Rudolf Brdička Lecture Hall

Professor Petr Slavíček received his M.Sc. in chemistry from Faculty of Science, Charles University, followed by a Ph.D. in molecular physics from Faculty of Mathematics and Physics. After a postdoctoral stay at University of Illinois (with Todd J. Martínez), he established his research group of Theoretical Photodynamics at University of Chemistry and Technology. The group focuses on theoretical modelling of light induced processes in condensed matter; the group most current research areas are devoted to interactions of high-energy radiation with matter.

Röntgen's discovery of a new kind of radiation produced a sensation which immediately stimulated chemical applications. In fact, X-rays have dramatically transformed the chemistry landscape, starting with quantitative analysis, structural theory up to understanding ultrafast processes on the attosecond time-scale. More than 120 years later, our molecular-scale knowledge of X-ray interaction with matter remains surprisingly humble. In my talk, I will briefly review the glorious history of X-rays in chemistry. I will then focus on novel types of intermolecular energy and charge relaxation processes triggered by interaction of high-energy radiation with molecules in the condensed phase, such as Intermolecular Coulomb Decay (ICD), Electron Transfer Mediated Decay (ETMD) or proton transfer mediated electronic decays. I will discuss the applicability of these processes for novel liquid state and interface spectroscopies. Finally, I will present the potential for targeted molecular transformations via X-rays, i.e. X-ray photochemistry. In the talk, I will present both the results of theoretical calculations from our laboratory and experimental approaches used in cooperating experimental groups, and I will briefly report on new application possibilities opened up by novel high-energy photon sources (synchrotrons, free electron lasers, table top x-ray sources).