

# Colloquium

## Wednesday, January 16<sup>th</sup> at 2 pm

**Prof. Stefan Lochbrunner – Universität Rostock**

### **Initial Steps in Photocatalysis Investigated by Time-Resolved Spectroscopy**

Photocatalysis attracts currently intense scientific interest since it allows to apply sunlight for the sustainable synthesis of energy rich compounds. An example is photocatalytic water splitting which we investigate in collaboration with M. Beller and coworkers from the Leibniz Institute of Catalysis focusing on the water reduction side of the process. To understand the reaction mechanisms and efficiency limiting factors, time-resolved spectroscopy is applied to a homogenous photocatalytic model system based on iridium or copper complexes as photosensitizer. By femtosecond pump-probe experiments the ultrafast intramolecular electronic relaxation processes of the metal complexes are studied including intersystem crossing and interligand charge transfer. The analysis of photoluminescence quenching using a streak camera provides insights into the interaction between molecular components resulting e. g. in bimolecular reactions and intermolecular charge transfer. For the iridium sensitizer we find that the electron transfer from a donor substrate to the metal complex, which is the first charge transfer step in the photocatalytic reaction path, is surprisingly improbable. However, the long triplet lifetime of the Ir-complex in combination with a high substrate concentration leads nevertheless to an efficient system. In the case of copper complexes the situation is different. The photoluminescence studies indicate that the oxidative electron transfer from the sensitizer to the catalyst is the first step. To observe the ionic products of this reaction we resort to absorption measurements applying a YAG-laser system for excitation. This allows to perform pump-probe experiments on timescales from nano- to milliseconds by means of an electronic delay generator. The measurements not only show that the electron transfer takes indeed place but provide also information about its efficiency and the contribution of non-reactive loss channels.