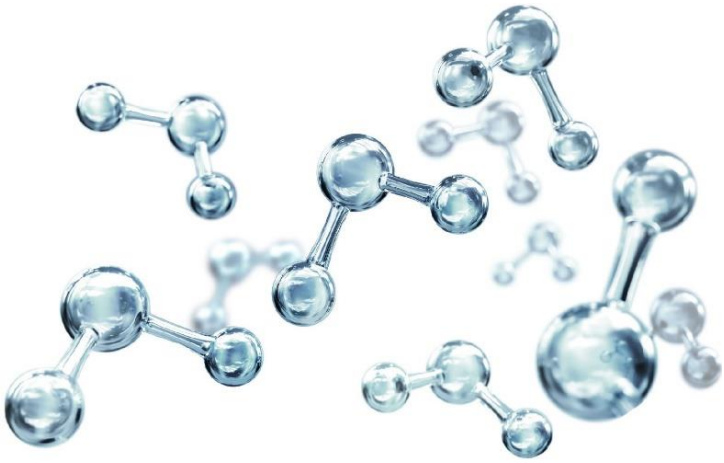
Seminar

CMWS Centre for Molecular Water Science

09th of January 2025
12:00 h (CET)

Zoom Virtual Meeting:

https://tuhh.zoom.us/j/82631283465
Meeting-ID: 826 3128 3465
Password: 978444



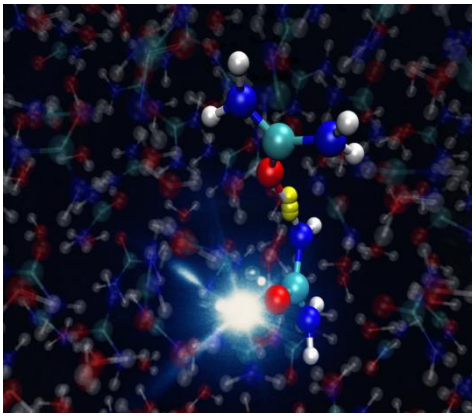
Zhong Yin

International Center for Synchrotron Radiation Innovation Smart
Tohoku University

Unveiling Chemical Dynamics: Time Resolved Spectroscopy with a Water Window X-ray Source

Light-matter interactions are fundamental processes that govern much of the natural world. The initial absorption of light by a system triggers a cascade of dynamic processes within its complex environment. Understanding each step of this intricate pathway at the molecular level remains one of the most significant challenges in current research, largely due to the ultrafast timescales and the intricate coupling between electronic and nuclear dynamics.[1] As a result, the development of experimental techniques capable of real-time observation—effectively creating a "molecular movie"—has become a primary focus of cutting-edge research. These methods allow for the probing and visualization of dynamic molecular processes as they occur, providing unprecedented insights into fundamental interactions.[2]

In this talk, I will present experimental examples that leverage the power of X-ray spectroscopy to investigate chemical systems in their natural environments, the liquid phase. X-ray spectroscopy is an element-, site-, and orbital-specific method that acts as a local probe, granting unparalleled access to the electronic structure of molecules.[3,4] This capability makes it an indispensable tool for unraveling the complex dynamics of chemical systems. The work presented here utilized innovative "water window" tabletop photon sources.[5-7] These sources have significantly advanced the field by providing exceptional temporal resolution, enabling soft X-ray spectroscopy to achieve breakthroughs that were previously unattainable with other techniques.[8,9] These advancements have pushed the boundaries of what is possible, opening new avenues for studying molecular dynamics and environmental effects with unprecedented precision.



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[9] Y.P. Chang et al Nature Physics, (2024) https://doi.org/10.1038/s41567-024-02703-w