The 909th IMS colloquium
since 1976

Small and Fast: Coherent Å-fs Chemistry

Prof. Wilson Ho

University of California, Irvine

Date & Time: 2017/10/12 (Thu.) 16:00-
Place: IMS Research Building Room 201

This colloquium will also be held as a Morino lecture.

Inhomogeneity of different length scales is one of the fundamental characters of space and matter that has its origin in the spatial variations of the charge and mass distributions. While many changes in nature and in the laboratory can be observed with the naked eyes, ultimately the interactions that lead to these changes occur at the atomic scale. In addition, heterogeneity influences the time scale that transformations occur at different locations, and the average time may differ significantly from the local times. The desire to understand and control changes in the charge and mass distributions would require experimental tools that possess simultaneous spatial and temporal resolutions to reveal the heterogeneity.

The relevant scales in chemistry relate to the motions of atoms in molecules that occur at fraction of a vibrational period and <0.1 nm distance. This joint Å-fs resolution can be achieved by the combination of a femtosecond laser with a low temperature scanning tunneling microscope (fs-STM) in ultrahigh vacuum that probes chemical transformations of single molecules. As a first demonstration, the dynamics of the conformational change in a single molecule adsorbed on a metal surface was followed in the time domain, revealing the vibrational reaction coordinate and the temporal decay of the coherently excited state that drives the conformational change [1]. In addition, the effects on the single molecule dynamics by a nearby molecule were determined. These experiments demonstrate the fs-STM approach in probing the effects of heterogeneity in space and time on the chemical dynamics in single molecules.

[1] S. Li, S. Chen, J. Li, R. Wu, and W. Ho, *Phys. Rev. Lett.,* submitted (2017).

Contact : Takeshi Yanai & Takao Fuji (IMS colloquium FY2017 committee)