TAN Howe-Siang
Assistant Professor
Division of Chemistry and Biological Chemistry
School of Physical & Mathematical Sciences
BSc (Hon.), National University of Singapore
PhD, Princeton University

Major Research Interest: **Ultrafast Laser Spectroscopy**
Other Interests: **Nonlinear Optics**

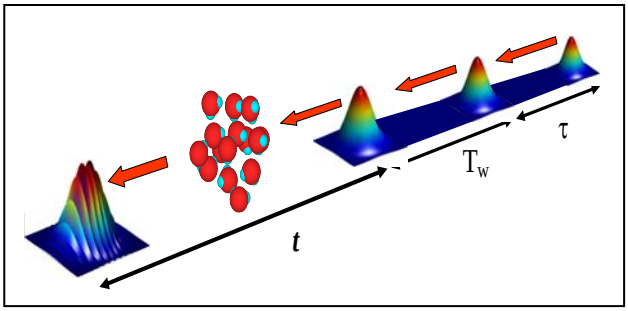
Email: **howesiang@ntu.edu.sg**
Tel: **(65) 6316 2987**

Many chemical reactions and dynamics happen in the femtosecond (10^{-15} sec) to picosecond time regime (10^{-12} sec). The only way to directly study systems at such short timescale is through ultrafast laser spectroscopy. In ultrafast laser spectroscopy, short laser pulses of tens or hundreds of femtoseconds duration are used to excite and probe the relevant chemical system

We are interested in the ultrafast vibrational dynamics of systems of chemical and biological interest. These systems include the hydrogen bond dynamics of water molecules in various different biological environments. The knowledge of such water systems is essential in understanding the workings of many biological processes.

We are also interested in using ultrafast vibrational spectroscopy to study the cis-trans isomerization process of photoisomers such as rhodopsins and xanthopsins. Upon excitation by a photon, these photoisomers undergo a cis-trans isomerization process. This isomerization process typically occurs in a timescale of a few hundred femtosecoonds. The consequent structural change of the associated biomolecules is key to many physiological processes such as vision.

The experimental techniques used in such studies include polarization controlled pump-probe experiments to measure the vibrational excited state dynamics and rotational anisotropy of molecular systems; vibrational photon echoes to measure the spectral diffusion.



Ultrashort mid infrared laser pulses are used to probe the ultrafast dynamics of systems of chemical and biological importance. The experimental techniques used in such studies include polarization controlled pump-probe experiments to measure the vibrational excited state dynamics and rotational anisotropy of molecular systems; vibrational photon echoes to measure the spectral diffusion.

Selected Publications

H.-S. Tan, I.R. Piletic, and M.D. Fayer, “Polarization selective spectroscopy experiments: Methodology and pitfalls”, J. Opt. Soc. Am. B, 22, 2009 (2005)

I.R. Piletic, H.-S. Tan, R.E. Riter, N.E. Levinger and M.D. Fayer, “Ultrafast IR spectroscopic study of nanoscopic water dynamics in AOT reverse micelles”, J. Phys. Chem. B, 109, 21273 (2005).

H.-S. Tan, I.R. Piletic, and M.D. Fayer, “Orientational dynamics of water confined on a nanometer length scale in reverse micelles”, J. Chem. Phys., 122, 174501 (2005).

H.-S. Tan, I.R. Piletic, R.E. Riter, N.E. Levinger, and M.D. Fayer, “Dynamics of water confined on a nanometer length scale in reverse micelles: Ultrafast infrared vibrational echo spectroscopy” Phys. Rev. Lett., 94, 57405 (2005).

H.-S. Tan, and W.S. Warren, "Mid infrared pulse shaping by optical parametric amplification and its application to optical free induction decay measurement" Opt. Express, 11, 1021 (2003).

H.-S. Tan, E. Schreiber, and W.S. Warren, " High resolution indirect pulse shaping by parametric transfer", Opt. Lett., 27, 439, (2002)

H.-S. Tan, W.S. Warren, and E. Schreiber, " Generation and amplification of ultrashort shaped pulses in the visible by a two-stage noncollinear optical parametric process", Opt. Lett., 26, 1812, (2001).