Construction and validation of a time resolved terahertz imaging spectrometer

Description: Construct and validate a time resolved Raman imaging spectrometer for use in studies on devices used in water technology. Fig.1 shows a snapshot of a similar system in the lab (left) and the diagram of such spectrometer as used in a recent publication (right). Phenomena such as interface polarization, diffusion limited aqueous chemical reactions, and microbial transport dynamics lie at the heart of processes essential to managing water resources on the planet. This project aims to provide a new tool to allow researchers to not only optimize existing approaches but to also determine the underlying mechanisms which practically limit the efficacy of current technologies.

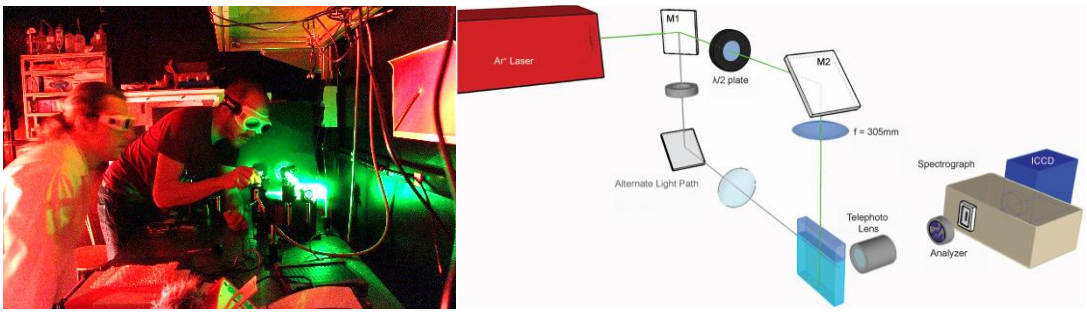

Fig. 1: Wetsus Optical Metrology Lab (snapshot, left); Diagram of a imaging Raman spectrometer [1]

The instrument will utilize a high power frequency doubled fiber laser to drive Raman transitions in liquid samples coupled to a monochromator with an RF gated detector. The project involves the construction of the frequency doubling bowtie cavity, sample delivery and collection optics, as well as frequency locking electronics. Two RF circuits are utilized in the experiment: 1) Pump energy is optimized through a Pound-Drever-Hall cavity feedback loop and 2) Experimental event trigger (e.g. pulsed electrical power) and detector collection phase angle are controlled for time resolved studies. The collection optics provide both spatial and frequency filtering and have independent optical trains for examining different molecular energy modes. The instrument once constructed will be validated by recording temperature dependent spectra in a number of liquid samples with and without a pulsed electric field.

Candidate requirements: A background in optics, spectroscopy, and optical microscopy is required. Direct experience with optical assembly and cavity construction is preferred. Strong communication and good organizational skills along with experimental experience are essential. Knowledge of physical chemistry and electromagnetism is also desired.

Application: If you are interested in this project, please contact Dr. Adam D. Wexler (adam.wexler@wetsus.nl) for more information or directly apply by sending your CV to the same address. The internship/MSc thesis includes a reimbursement for living expenses of 350 euro per month.

References: Interested candidates are referred to the following papers.

[1] A. D. Wexler, S. Drusová, J. Woisetschläger, and E. C. Fuchs, "Non-equilibrium thermodynamics and collective vibrational modes of liquid water in an inhomogeneous electric field," *Phys. Chem. Chem. Phys.* **18** no. 24 (2016)

[2] P. Herskind, J. Lindballe, C. Clausen, J.L. Sørensen, M. Drewsen, "Second-harmonic generation of light at 544 and 272 nm from an ytterbium-doped distributed feedback fiber laser," *Opt. Lett.*. **32** no. 3 (2007)