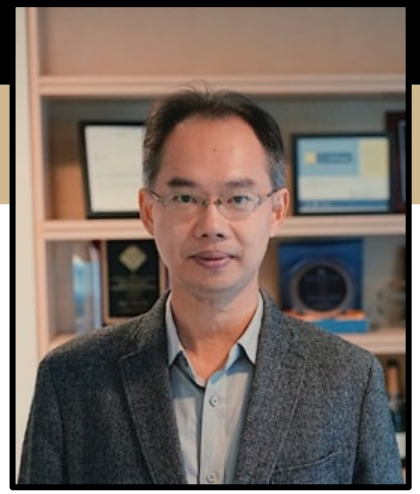
DEPARTMENTAL COLLOQUIUM



Professor Wei Min

Department of Chemistry
Columbia University

"Water at the Edge: On-Water Spectroscopy across Oil Droplets, Protein Surfaces, and Living Cells"

Abstract:

Interfacial water exhibits rich and complex behavior, playing a critical role in chemistry, biology, geology, and engineering. Despite its importance, fundamental properties of water at hydrophobic interfaces—such as orientational ordering, hydronium and hydroxide concentrations, improper hydrogen bonding, and the presence of strong electric fields—remain highly debated. These controversies arise from the inherent challenges in probing interfacial systems, even with state-of-the-art experimental techniques. In this seminar, I will present newly developed on-water optical spectroscopy capable of investigating diverse interfacial systems, including oil-water emulsions, protein hydration shell, and even the interior of living mammalian cells. These techniques provide insights into key properties such as interfacial water's tetrahedral structure, free O-H groups, electrostatics, illuminating the remarkable chemical activity observed at hydrophobic-water interfaces such as in microdroplets and contact electro-catalysis. Additionally, I will discuss the broader implications for materials science, environmental studies, and biomedical research.

Biography:

Wei Min received his B.S. from Peking University in 2003 and Ph.D. from Harvard University in 2008 studying single-molecule biophysics with Prof. Sunney Xie. After continuing his postdoctoral work in Xie group, Dr. Min joined the faculty at Columbia University in 2010, and was promoted to Full Professor there in 2017. He is also affiliated with Department of Biomedical Engineering, and Kavli Institute for Brain Science.

Dr. Min's contribution has been recognized by a number of honors, including Biophotonics Technology Innovator Award from SPIE (2023), Raman Award for the Most Innovative Technological Development (2022), Craver Award of Vibrational Spectroscopy (2022), Scientific Achievement Award from Royal Microscopical Society (2021), Pittsburgh Conference Achievement Award (2019), Analyst Emerging Investigator Lectureship (2018), Coblentz Award of Molecular Spectroscopy (2017), the ACS Early Career Award in Experimental Physical Chemistry (2017), Camille Dreyfus Teacher-Scholar Award (2015), Alfred P. Sloan Research Fellowship (2013), and NIH Director's New Innovator Award (2012).