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*Development of High Spatial and Spectral Resolution Chemical Imaging Tool for Biological Interfaces*

Dr. Naihao Chiang obtained his BS in chemistry, physics, and economics/mathematics from the University of Southern California and a Ph.D. in applied physics from Northwestern University. He joined the Department of Chemistry at the University of Houston in 2021. His group focuses on extending the capability of label-free single-molecule optical spectroscopy to nanomedicine by designing instruments specifically for nanoscale chemical imaging under liquid environments.

Abstract: Tip-enhanced Raman spectroscopy (TERS) combines the nanoscale spatial resolution of scanning probe microscopy with the single-molecule chemical sensitivities of surface-enhanced Raman spectroscopy. TERS has achieved Ångström-scale spatial resolution in chemical imaging under ultrahigh vacuum conditions. We are developing a custom-built laser-coupled scanning ion-conductance microscope (SICM) for TERS, which enables translating this unprecedented spatial resolution in vibrational spectroscopy to ionic environments. SICM is an SPM technique suitable for topological imaging biological interfaces in controlled liquid environments. I will discuss the instrumental design considerations for SICM-TERS. Our proof-of-concept experiments on inorganic material model systems have already demonstrated the rich chemical information available from SICM-TERS. Preliminary results of the near-field enhanced spectroscopy on in-vitro specimens also show promising routes toward label-free chemical characterization of biological interfaces. This emerging chemical imaging method allows researchers to obtain more detailed chemical information on soft interfaces in electrolyte solutions.