CHEMISTRY & BIOCHEMISTRY COLLOQUIUM: Localized Surface Field as Omnipotent Probe of Physicochemical Processes

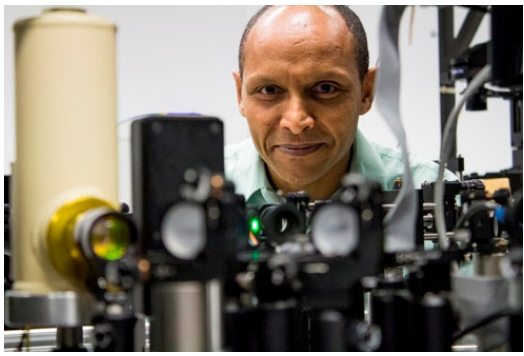
Terefe G. Habteyes
Associate Professor, Chemistry & Chemical Biology
University of New Mexico

Date:
12/12/2021

Time:
1:30 PM-2:50 PM

Link:
Please contact snsgradstaff@ucmerced.edu for the Zoom information.

About the Speaker:



Dr. Habteyes received his B.S. and M.S. degrees in Chemistry from Addis Ababa University in 1997 and 2000, and his Ph.D. in Chemistry from the University of Arizona in 2008 working with Prof. Andrei Sanov. He was a postdoctoral fellow at the University of California at Berkeley and Lawrence Berkeley National Laboratory from 2008 to 2012 working with Prof. Stephen Leone and Prof. Paul Alivisatos . He started his assistant professor position at the University of New Mexico in August 2012. He has been promoted to associated professor with tenure since July 2018.

Abstract:

In this presentation, it will be demonstrated that localized surface electromagnetic field can be used for probing a variety of physicochemical processes. Results of scattering-type scanning near-field optical microscopy (s-SNOM) show that a sharp conical probe can be used as an optical antenna to probe localized surface optical modes and chemical heterogeneity with spatial resolution on the order of 10 nm. On the other hand, localized surface plasmon resonances of metal nanoparticles can be used for obtaining in-depth understanding of surface photochemistry by probing different physicochemical processes. The plasmonic effect is used to initiate and probe model surface reactions (oxidation of non-resonant para-aminothiophenol and N-demethylation of resonant methylene blue) that reveal the roles of electron transfer and plasmon-pumped intramolecular electronic excitation. Our experimental results indicate that intermediary surface ligands can enhance or block electron transfer depending on the geometry of the analyte molecules. In addition, the presence of surface ligands can facilitate plasmon-pumped adsorbate intramolecular electronic excitation by orienting the analyte molecules along the surface field vector as well as by prolonging the excited state lifetime. It will also been shown that particle plasmons can be used to probe photocarrier diffusion in semiconductor heterostructures. Similarly, by coupling anisotropic plasmonic nanoparticles to metal film, cavity plasmon resonances with relatively long dephasing time can be created, and these plasmon resonances provide ideal platform to investigate the importance of quantum effects and to enhance light-matter interactions.

For more information, contact : Son Nguyen
son@ucmerced.edu