Nanoparticle plasmonics: Application to single-molecule catalytic reactions and nanoscopic chemical imaging

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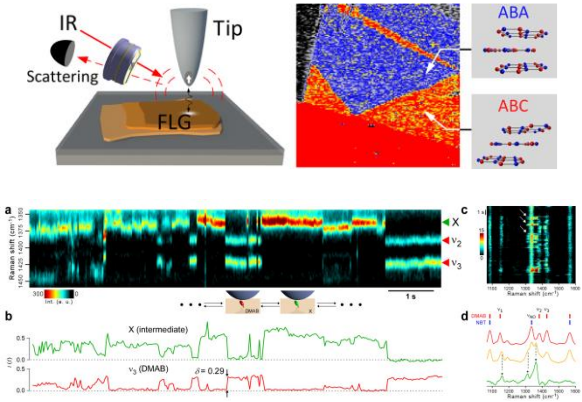
The nano-particle plasmonics, the resonant oscillation of electrons driven by light, offers many possibilities ranging from trace-level detection of molecules to opto-electronic devices. In this talk, I will present my research group's recent investigation on how the localized plasmon of a nanoparticle interacts with another plasmon, and with nearby molecules. First, I will demonstrate the use of scattering-type scanning near-field microscopy (s-SNOM) to directly visualize the capacitive / conductive coupling in dimeric nanoparticles and heterometallic nanorods. Second, I will talk about the use of gap-plasmons to locally induce photochemical reactions, and to follow chemical kinetics of individual organic molecules using the gap-plasmons. Finally, I will talk about the use of near-field coupling between a scanning probe and 2D-materials to visualize / identify the stacking domains (e. g., ABA versus ABC-type stacking in triple layer) hidden in multilayer graphenes.



(top) the infrared nanoscopy imaging of trilayer graphene; (bottom) time-dependent SERS spectra of single-molecule dimercapto-azobenzene reaction intermediates