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Optical Response of Absorbates in the STM Environment; The Influence of the STM Tip and Plasmonic Effects[1] PING CHU, D.L. MILLS, University of California, Irvine — STM is widely used to explore the excited states and related optical properties of adsorbates on metal surfaces. The adsorbate may be placed on a thin oxide layer that is grown on the metallic substrate. One may ignore the direct hybridization between the adsorbate electrons and those in the substrate. We have developed the theory of the optical response of adsorbates in such an environment. Electrons in the adsorbate may interact with the electronic degrees of freedom in the tip/substrate complex through the fluctuating electric fields generated by the zero point motions of electrons in the substrate and the tip. The coupled plasmons of the tip/substrate complex contribute to these fluctuating fields. We have developed a formalism which allows us to describe energy level shifts of the adsorbate orbitals and the non radiative decay rate of excited states from coupling to the electronic degrees of freedom in the tip and substrate. We have also developed a theory of plasmon enhanced radiation emission under the tip, where the coupled plasmons of the tip/substrate complex are responsible for the enhancement of the emission.

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