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Plasmonic Nanostructures: Artificial Molecules

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The recent observation that metallic nanoparticles possess plasmon resonances that depend sensitively on the shape of the nanostructure has led us to a fundamentally new understanding of the plasmon resonances supported by metals of various geometries. This picture- "plasmon hybridization",[1] reveals that the collective electronic resonances in metallic nanostructures are mesoscopic analogs of the wave functions of simple atoms and molecules, interacting in a manner that is analogous to hybridization in molecular orbital theory. The new theoretical insight gained through this approach provides an important conceptual foundation for the development of new plasmonic structures that can serve as substrates for surface enhanced spectroscopies and subwavelength plasmonic waveguiding and other applications. The talk is comprised of general overview material of relevance for chemical applications interspersed with a few more specialized "hot topics" such as plasmonic interference effects,[2] Quantum effects,[3] and single molecule SERS and LSPR sensing.[4]

[1]H. Wang et al., Acct. Chem. Res. 40(2007)53
[2]J.A. Fan et al., Science 328(2010)1135, J.B. Lassiter et al., Nano Lett. 10(2010)3184
[3]J. Zuloaga et al., Nano Lett. 9(2009)887, ACS Nano 4(2010)ASAP
[4]D. Ward et al., Nano Lett. 8(2008)919, K.S. Mayer et al., Nanotechnology 21(2010)255503