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Optical Spectroscopy of Plasmon-enhanced Emissions and Scatterings for Advanced Photonic Devices[1]

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Quantum electrodynamic coupling between excitons or phonons and plasmons has been of great interest for fundamental scientific research and photonic applications of lighting devices and bio-chemical sensing. Exciton-plasmon coupling of semiconductor quantum dots (SQDs) and metal nanoparticles (MNPs) provides high internal quantum efficiencies because of the localized surface plasmon resonance (LSPR) excitation and the faster coupling decay rates compare to the nonradiative decay rates. The enhancement and quenching of internal quantum efficiencies are determined by the coherent coupling condition and the balance between the faster resonant energy transfer from SQDs to MNPs than the nonradiative decay in SQDs and local field enhancement in the vicinity of MNPs. The resonant coupling of phonon-plasmon with analyte-linked MNPs also provides large enhancement of vibrational intensity in the analyte molecule because of strong LSPR and large polarizability of dimer-like MNP assemblies along the long-axis direction. Major physical origins of scattering enhancement could be the localized electromagnetic hot spots, the chemical energy transfer effects, and the spectral resonant excitation to the longitudinal plasmon modes. *Acknowledgments:* This work at Hampton University was supported by the National Science Foundation (HRD-0734635 and HRD-0630372).

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