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Vibrations: Plasmon-Exciton Coupling in Gold/Molybdenum Disulfide Hybrid Systems[1] MICHAEL REYNOLDS, Columbia State Community College, JED ZIEGLER, AKM NEWAZ, KIRILL BOLOTIN, RICHARD HAGLUND, Vanderbilt University — Monolayer molybdenum disulfide (MoS_2) represents a unique platform for investigating the dynamics of exciton-plasmon interactions. We report on a hybrid system composed of Au nanoparticles (NPs) lithographically fabricated on monolayer MoS_2 flakes. The NPs are fabricated with dimensions that support plasmonic resonances, which are the optically induced oscillations of the conduction electrons within the metallic NP, in the same spectral region as the MoS_2 exciton emission. This hybrid system shows a significant enhancement of the exciton emission as well as a blue-shift in the characteristic exciton peaks. We study the modification of exciton photoluminescence by tuning the resonance of the plasmons around the exciton emission energies. From this geometric tuning, we are able to both tune the enhancement of exciton emission and blue-shift the emission peak. This behavior is distinct from the spectral behavior of the individual MoS_2 and plasmonic constituents suggesting a new metamaterial is formed by this hybrid geometry. Our results suggest that the MoS_2/plasmon hybrid systems have potential as high efficiency light harvesters, broadband emitters and as tunable visible and NIR photodetectors.

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