

Abstract Submitted  
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**Managing photons and carriers for photocatalysis** ISABELL THOMANN, HOSSEIN ROBATJAZI, SHAH BAHAUDDIN, CHLOE DOIRON, XUEJUN LIU, THEJASWI TUMKUR, WEI-REN WANG, PARKER WRAY, Rice University — While small plasmonic nanoparticles efficiently generate energetic hot carriers, light absorption in a monolayer of such particles is inefficient, and practical utilization of the hot carriers in addition requires efficient charge-separation. Here we describe our approach to address both challenges. By designing an optical cavity structure for the plasmonic photoelectrode [1], light absorption in these particles can be significantly enhanced, resulting in efficient hot electron generation. Rather than utilizing a Schottky barrier to preserve the energy of the carriers, our structure allows for their direct injection into the adjacent electrolyte. On the substrate side, the plasmonic particles are in contact with a wide band gap oxide film that serves as an electron blocking layer but accepts holes and transfers them to the counter electrode. The observed photocurrent spectra follow the plasmon spectrum, and demonstrate that the extracted electrons are energetic enough to drive the hydrogen evolution reaction. A similar structure can be designed to achieve broadband absorption enhancement in monolayer MoS<sub>2</sub> [2]. Time permitting, I will discuss charge carrier dynamics in hybrid nanoparticles composed of plasmonic / two-dimensional materials, and applications of photo-induced force microscopy to study photocatalytic processes. [1] Nano Letters, 2015, 15 (9), p 6155 [2] Photon management strategies for monolayer MoS<sub>2</sub>, submitted

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