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Spectrally-tuned plasmonic-excitonic photovoltaics using gold nanoshells[1] ANNA LEE, DANIEL PAZ-SOLDAN, SUSANNA THON, MICHAEL ADACHI, University of Toronto, HAOPENG DONG, Tsinghua University, POUYA MARAGHECHI, MINGJIAN YUAN, ANDRÉ LABELLE, SJOERD HOOGLAND, KUN LIU, EUGENIA KUMACHEVA, EDWARD SARGENT, University of Toronto
— Recent advances in spectrally-tunable solution-processed metal nanoparticles have provided unprecedented control over light at the nanoscale. Parallel progress in colloidal quantum dot photovoltaics offers the potential for low-cost, large-area solar power; however, these devices suffer from poor quantum efficiency in the more weakly-absorbed near infrared portion of the sun's spectrum. Here, we report a plasmonic-excitonic solar cell that combines two jointly-tuned solution processed infrared materials. We show through experiment and theory that a plasmonic-excitonic design using gold nanoshells with optimized single-particle scattering-to-absorption cross section ratios leads to a strong enhancement in near-field absorption and resultant photocurrent in the performance-limiting near infrared spectral region.

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