## SUPPLEMENTARY INFORMATION

## Ultrafast Carrier Dynamics in Bimetallic Nanostructure-Enhanced Methylammonium Lead Bromide Perovskites

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**Figure S1.** Representative TEM image of Au/Ag nanostructures showing two distinct geometries, nanocubes and nanopyramids.



**Figure S2.** Cross-sectional SEM micrograph of the MAPbBr<sub>3</sub>-sensitized TiO<sub>2</sub> full device from Figure 1b without color modifications.



Figure S3. Enhancement in (a) absorbance and (b) IPCE in 0.5 wt% and 1.0 wt% devices compared to reference spectra.



**Figure S4.** Average and best (a) open-circuit voltage, (b) fill factor, (c) short circuit current density, and (d) power conversion efficiency values for devices as a function of Au/Ag nanostructure particle density (wt%). Error calculated from standard deviations calculated over a range of ~10 devices tested at each concentration.



**Figure S5.** Decay kinetics at 490 nm for the reference  $(TiO_2 + MAPbBr_3)$  and Au/Ag/SiO<sub>2</sub>NS plasmon-enhanced samples. Kinetics are shown with experimental data (symbols) fitted with a biexponential decay function (smooth lines). Early time scales are plotted linearly; later time scales (>10 ps) plotted on a logarithmic scale with a base of 10.

**Table S1.** Amplitudes (A), time constants ( $\tau$ ), and amplitude weighted lifetimes ( $\tau_{avg}$ ) derived from biexponential fits of the transient absorption for the different samples at the photoinduced absorption band located at 490 nm.

Sample	A <sub>1</sub>	τ <sub>1</sub> [ps]	A <sub>2</sub>	τ <sub>2</sub> [ps]	τ <sub>avg</sub> [ps]
MAPbBr <sub>3</sub>	0.20	77.20	0.78	294.45	249.25
0.5 wt% Au/Ag/SiO <sub>2</sub>	0.28	97.54	0.67	228.02	189.47
1.0 wt% Au/Ag/SiO <sub>2</sub>	0.76	75.33	0.23	513.13	176.61