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Mode matching for optimal plasmonic nonlinear generation KEVIN O'BRIEN, HAIM SUCHOWSKI, JUN SUK RHO, BOUBACAR KANTE, XIAOBO YIN, XIANG ZHANG, NSF Nano-scale Science and Engineering Center (NSEC), University of California, Berkeley, California — Nanostructures and metamaterials have attracted interest in the nonlinear optics community due to the possibility of engineering their nonlinear responses; however, the underlying physics to describe nonlinear light generation in nanostructures and the design rules to maximize the emission are still under debate. We study the geometry dependence of the second harmonic and third harmonic emission from gold nanostructures, by designing arrays of nanostructures whose geometry varies from bars to split ring resonators. We fix the length (and volume) of the nanostructure on one axis, and change the morphology from a split ring resonator on the other axis. We observed that the optimal second harmonic generation does not occur at the morphology indicated by a nonlinear oscillator model with parameters derived from the far field transmission and is not maximized by a spectral overlap of the plasmonic modes; however, we find a near field overlap integral and mode matching considerations accurately predict the optimal geometry.

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