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Title:Quantitative modeling of the third harmonic emission spectrum of plasmonic nanoantennas
Authors:Hentschel, Mario (1); Utikal, Tobias (1); Giessen, Harald (1); Lippitz, Markus (1)
Author affiliation:(1) 4th Physics Institute and Research Center SCoPE, University of Stuttgart, D-70569 Stuttgart, Germany; (2) Max Planck Institute for Solid State Research, Heisenbergstrasse 1, D-70569 Stuttgart, Germany
Corresponding author:Lippitz, M.(m.lippitz@physik.uni-stuttgart.de)
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Abstract:Plasmonic dimer nanoantennas are characterized by a strong enhancement of the optical field, leading to large nonlinear effects. The third harmonic emission spectrum thus depends strongly on the antenna shape and size as well as on its gap size. Despite the complex shape of the nanostructure, we find that for a large range of different geometries the nonlinear spectral properties are fully determined by the linear response of the antenna. We find excellent agreement between the measured spectra and predictions from a simple nonlinear oscillator model. We extract the oscillator parameters from the linear spectrum and use the amplitude of the nonlinear perturbation only as scaling parameter of the third harmonic spectra. Deviations from the model only occur for gap sizes below 20 nm, indicating that only for these small distances the antenna hot spot contributes noticeable to the third harmonic generation. Because of its simplicity and intuitiveness, our model allows for the rational design of efficient plasmonic nonlinear light sources and is thus crucial for the design of future plasmonic devices that give substantial enhancement of nonlinear processes such as higher harmonics generation as well as difference frequency mixing for plasmonically enhanced terahertz generation. © 2012 American Chemical Society.
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Controlled terms:Antennas - Emission spectroscopy - Harmonic generation - Light sources - Nonlinear optics - Oscillators (mechanical)
Uncontrolled terms:Complex shapes - Difference-frequency mixing - Different geometry - Field enhancement - Gap size - Higher harmonics generation - Hot spot - Linear response - Nanoantennas - Non-linear oscillators - Nonlinear effect - Nonlinear perturbations - Nonlinear

process - Optical field - Oscillator model - Oscillator parameters - Plasmonic - Plasmonic devices - Plasmonics - Quantitative modeling - Rational design - Scaling parameter - Shape and size - Spectral properties - Strong enhancement - Terahertz generation - Third harmonic

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