Nonlinear optics at the nanoscale

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Abstract:

Development of nanotechnologies and interest for metamaterials has put a renewed interest on the subject of nonlinear optical properties of patterned metallic structures. Structures made of metal sub-wavelength objects like nanorods , or nano horseshoe shaped resonators and nanowires periodically arranged in dielectric matrices have been realized and linearly characterized. The same way, the linear behaviour of transmitted fields trough nano-apertures and slits on metal screens have been deeply investigated. It is well known that sub-wavelength features can be responsible for transparency regions in the visible range. Indeed, enhanced transmission from thick metal screens with sub-wavelength apertures has been extensively studied and observed in the linear regime [1]. The phenomenon in based on surface plasmon polariton excitation and fulfilment of resonant conditions inside the aperture as a function of the screen depth [2] leading to field's enhancement effects . Nevertheless, the study and the understanding of non linear phenomena in these systems is still at a seminal stage concerning theoretical models and numerical tools. Several models have been proposed in the regime of quasi static approximation or by taking advantage of effective medium approximation. .. In this work we present an overview of a numerical method developed [3] in order to study the nonlinear quadratic response of nanopatternd metals , of different metallic geometries and dielectric structures . A comparison with esperimental results [4] is also presented .

References:

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