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Analysis of Resonant Excitation Multipolar Optical Modes in Dielectric Nanosphere and Enhanced Scattered Radiation at Second Harmonic

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ABSTRACT

We have analysed the resonant excitation multipolar optical modes in the dielectric nanosphere and enhanced scattered radiation at second harmonic. The study was made using Laguerrl-Gaussian beams process. Scattering of circularly polarized Laguerre-Gaussian beams from single plasmonic and dielectric nanospheres study was made. Rotational symmetry of scatterer was analysed. Nanotechnology was used for the study of second harmonic generation from plasmonic and dielectric nanoparticles. It was found that plasmonic nanostructures supported localized surface plasmon polaritons for optical devices. It was found that rotational symmetries affected the transfer of optical momentum from incident beams in the case of scattered and second harmonic fields. It was also found that dielectric nanostructures produced low intrinsic loss and high power threshold. High frequency conversion efficiency was found due to nanostructures of dielectric. Resonances were found in the spectral regions where intrinsic optical losses were not available. Larger nanosphere favored the production of excitation and appearance of resonances.

KEYWORDS

Resonant, excitation, muiltipolar, nanosphere, second harmonic, plasmonic, Gaussian beams, nanostructure.

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INTRODUCTION

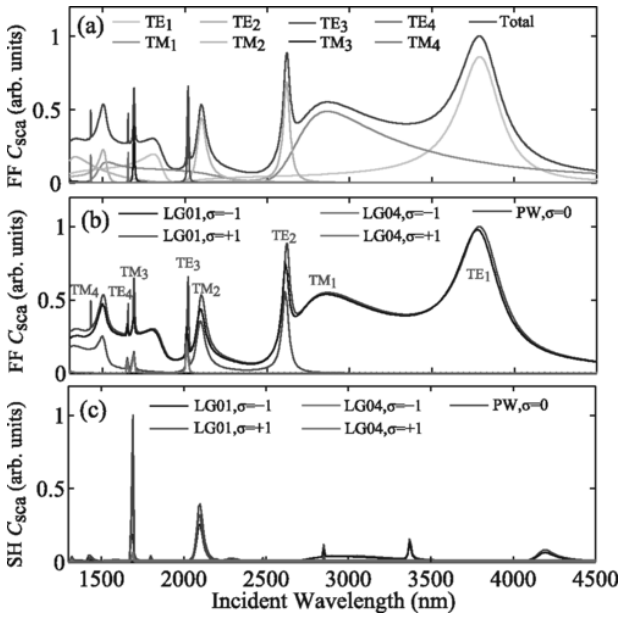
Mair et al.[1] used nonlinear processes for study of high capacity optical communications. Chen et al.[2] presented the enhancement of non linear optical activity and control of phase. Li et al.[3], Bloch et al.[4] and Buono et al.[5] presented the control of optical angular momentum. Ciraci et al.[6], Biris et al.[7] and Cazaplicki et al.[8] used the advanced nanotechnology to study nanoparticles were centro-symmetric optical. Butet et al.[9], Valev et al.[10] and Biris et al.[11] used second harmonic generation technique for the study of powerful tool for surface characterization, biomedicine and nanotechnology application and found requirement of nanostructures in spin orbit interaction for surfaces. Shcherbakov et al.[12] and Carletti et al.[13] presented the dielectric nanostructures production when resonant modes were applied. Simpson et al.[14] and Padgett and Bowman[15] studied that momentum were applied for technological use and also for tweezers. Wang et al.[16] and Bozinovic et al.[17] used high capacity optical communications for technological applications. Mirhosseini et al.[18] presented quantum key distribution. Allen et al.[19] used Laguerre- Gaussian beams for the study of plasmonic and dielectric nano structures on second harmonic generation process.

METHOD

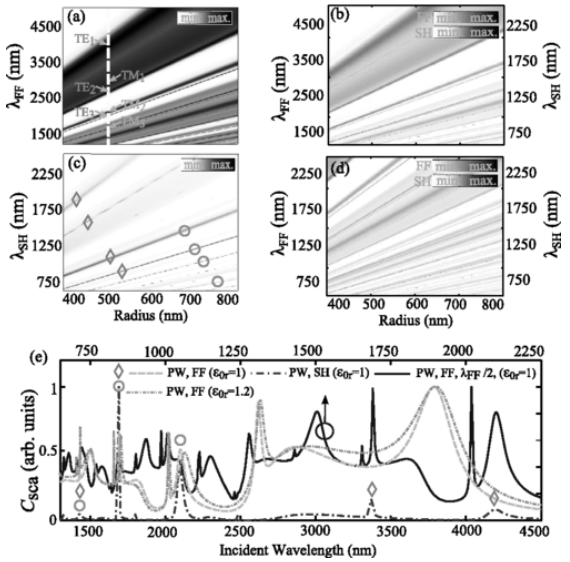
Nanotechnology was used for the study of second harmonic generation from plasmonic and nanoparticles. The second harmonic generation is a powerful tool for the characterization of surface nanostructures. Plasmonic nanostructures favored surface plasmon polaritons for optical devices. Ohmic losses in plasmonic materials is essential for conversion efficiency and optical power. Dielectric nanostructures produce lower intrinsic loss due to which higher power is generated threshold. Dielectric nanostructures allowed higher frequency conversion efficiency when resonant modes were applied. Laguerre-Gaussian beams were used on second harmonic generation process for the study of plasmonic and dielectric nanostructures. Spin-orbit interaction in structure were analysed considering comparison of second harmonic Laguerre-Gaussian case. Characteristics of spin-orbit interaction mediated Centro symmetric. Laguerre-Gaussian beams with configuration got concentric ring structure having p-radial modes. The phase variation was obtained. Scattering of circularly polarized Laguerre-Gaussian beams of Centro symmetric materials prepared from nanospheres were studied. The rotational symmetry of the scatterer was analysed. Resonant excitation of multipolar optical modes having nanosphere in dielectric were analysed.

RESULTS AND DISCUSSION

We have calculated scattering at fundamental frequency. Second harmonic generation was taken into account for Centro symmetric materials. Nanostructures exhibited electrical conversion efficiency. Graph (1) shows the resonance peaks of Laguerre-Gaussian beams with $\ell = 1$ and $\ell = 4$. Graph (1) (c) shows the second harmonic comparison. It was found that second harmonic contained resonance at incident wave length. The strong second harmonic radiation at these wavelengths was found. Graph (2) shows the plot of normalized scattering versus linearly polarized plane waves. Graph (2) (c) shows the second harmonic fundamental frequency and second harmonic map. We have calculated fundamental frequency wave length ranged from 650 nm. The overlap of scattering at second harmonic which were arranged is shown in Graph (2) (d) . Overlap correspond to second harmonic as shown in Graph (2) (e). It was found that fundamental frequency and second harmonic mechanism corresponded to second harmonic.



Graph 1: Plot of normalized scattering versus nanosphere radius for incoming excitation.



Graph 2: Plot of spectra of normalized scattering cross section vs linealy polarized plane waves.

CONCLUSION

We have made analysis of resonance excitation multipolar optical modes in dielectric nanosphere and enhanced scattered radiation at second harmonic. Laguerre-Gaussian beams utilizing on the second harmonic generation process were studied for plasmonic and dielectric structures. Optical modes in dielectric nano sphere was considered. Nano technology was used for study of the required case. We have calculated the fundamental frequency of scattering using boundary element method. The analysis of polarized Laguerre-Gaussian beams from a single nanosphere was made. The resonances were found at the frequency Laguerre beams having polarization. It was found that the strong second harmonic radiation at wavelengths due to resonant advancement of optical field. It was found that the map of

fundamental and second harmonic produced linearly polarized plane wave excitation of multipolar optical modes produced enhanced scattered radiation for second harmonic.

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