Towards Chiral Acoustoplasmonics

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Abstract (Calibri
8The possibility of creating and manipulating nanostructured materials encouraged the exploration of new strategies to control electromagnetic properties. Among the most intriguing nanostructures are those that respond differently to helical polarization, i.e., exhibit chirality.[1] Circularly polarized light can be used to probe and determine the chiral nature of a plasmonic structure, which is usually reflected as quantitative differences in the values of the absorption or scattering cross-sections. However, reaching maximum absorption and minimum scattering for one helicity, and the opposite for the other is not usually found to occur at the same wavelength [2].

In the present work, we propose a simple chiral plasmonic structure based on crossed elongated bars where light-handedness defines the dominating cross-section absorption or scattering, as it identifies the two different enantiomers in a chiral structure which determine how the system interacts with its environment. The system is yet maintained simple enough to understand the actual nature of the response observed, be open to future developments, and warrant fabrication for future experimental verification [3]. Based on this structure, our work demonstrate that, not only through the interactions between different elements it is possible to make the absorption and scattering cross-sections radically and qualitatively different for the two circular polarizations, but the dominating cross-section can be switched from absorption to scattering by simply changing the polarization of the impinging beam [4]. Also, we theoretically propose a simple pump-probe experiment using circularly polarized light. In the reported structures, the generation of acoustic phonons is optimized by maximizing the absorption, while the detection is enhanced at the same wavelength -and different helicity- by engineering the scattering properties [5]. The presented results constitute one of the first steps towards harvesting chirality effects in the design and optimization of efficient and versatile acoustoplasmonic transducers.)

References

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