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Embedded Eigenstates and Coherent Virtual Absorption in Metamaterial Structures

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1. Extended Abstract

The possibility of engineering the scattering and absorption from an object is one of the most exciting directions offered by the field of metamaterials. Among the unusual responses that metamaterial covers have enabled over recent years, we have witnessed an explosion of interest for cloaking [1-3], superabsorption, compact quasi-static resonances, and several other opportunities for unusual electromagnetic responses.

We have recently been interested in exploring the opportunity to tailor the scattering of an open scatterer with metamaterial covers to realize an embedded scattering eigenstate within the radiation continuum [4-6]. In this paper, we discuss the possibility of confining electromagnetic energy and enhancing the interactions of light and matter in nanostructures, based on the concept of bound eigenstates, and how in this context metasurfaces and metamaterials may be able to trap light indefinitely in plain sight. Related to this concept, we will discuss how lossless structures may be able to store energy in the transient of specifically tailored excitations by engaging complex zeros in the scattering response of the system, and how, by using the concept of embedded scattering eigenstate, it may be possible to move these coherent virtual absorption states very close to the real axis.

As we discuss these issues, we also shed light on the important role that reciprocity plays in the response of these systems, and how these functionalities may be of relevance for low-energy nanophotonic, opto-electronic and bio-sensing devices.

2. References

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