

Fano Resonances and Collective Effects in Metamaterials

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Abstract- We review recent progress on the control of inter-meta-molecule interactions and collective effects in metamaterials.

Structuring materials at sub-wavelength scales to create metamaterials, emerges as a promising approach in achieving long-sought-for functionalities, such as perfect lensing and compact delay lines, as well as enabling exotic applications ranging from cloaking to magnetic mirrors. Inspired by the way that nature builds crystals through assembly of building blocks in periodic lattices, initial efforts focused in achieving effective medium behaviour, where an incident wave can not distinguish the intricate small-scale structure of the metamaterial. Recently, however, there is a growing interest in expanding the metamaterial playground to include analogs of essentially quantum effects, such as electromagnetically induced transparency, in order to create sharp Fano-type resonances and control collective phenomena that may or may not have a straight-forward counterpart in ordinary crystalline systems. In this talk, the recent introduction of coherent and incoherent metamaterials will be discussed and the properties of such systems which lead to novel effects in metamaterials, beyond the effective medium approximation will be reviewed.

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