Topological optics vs Fano resonance

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Abstract

Two fascinating interference phenomena related to the scattering of light in plasmonics materials: Fano resonances [1, 2] and topological optics [3, 4] (singular optics, vortices, and dislocations of the wave front) are seemingly not related, e.g. it is possible to observe Fano resonances without topological effects as well as singular optics is not necessary accompanied by resonance effects. The majority of plasmonic nanostructures with Fano resonances suffer from scaling. Meanwhile, it is possible to generate Fano resonances within the nanostructures with a very small value of the size parameter. The fascinating property of these "nano-Fano resonance" structures is related to the coexistence of the Fano resonance and topological optical effects, where the characteristic size of vortices is well beyond the diffraction limit, see an example shown in Figure 1. It provides an insightful mechanism to manipulate Fano resonance stably down to the extreme nanoscale. It also opens up an unprecedented way for manipulating vortices in topological optics.

Figure 1: The forward scattering $Q_{FS}$ and backscattering $Q_{BS}$ efficiencies and Poynting vector distributions for the light scattering by plasmonic cylinder with size parameter $q = 0.2$.

References