Shaping the Fano interference in Plasmonic Crystals

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The asymmetric Fano resonance originating from the interference of a narrow resonance with a broad spectral line or continuum of states is a universal phenomenon, observed in diverse quantum and classical systems. The Fano resonances observed in micro and nano optical systems have received particular attention due to their numerous potential applications like in sensing, switching, lasing, filters and robust color display, nonlinear and slow-light devices, invisibility cloaking, and so forth [1,2]. Most of the aforementioned applications are known to critically depend upon the ability to control or modulate the asymmetry of the spectral line shape by external means[1]. Thus, tuning the Fano resonance via some experimentally accessible parameters are highly desirable for realistic applications. We have recently demonstrated a simple yet elegant approach for probing, interpreting and tuning the Fano interference effect and the resulting asymmetric spectral line shape in an anisotropic optical system[3]. The approach is founded on a generalized model of anisotropic Fano resonance and exploits the different polarization response (anisotropy) of the two interfering modes to achieve unprecedented control over Fano resonance. Using this approach, it was demonstrated that the spectral asymmetry can be desirably tuned by modulating two experimentally accessible parameters of interference, namely, the Fano phase shift and the relative amplitudes of the interfering modes. In this talk, I shall introduce this concept and discuss our experimental results on tailoring various exotic regimes of Fano resonance in waveguided plasmonic crystal samples by pre and post selection of optimized polarization states of light [3,4]. In this regard, I shall also provide a brief account of our other ongoing studies in the domain of plasmonics, that on spin orbit interaction of light and spin optical effects in the plasmonic and other micro and nano-optical systems [5-10]. The implications of these studies towards development of novel spin-controlled photonic nano devices will be highlighted.

References

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