Chiral and Plasmonic dimers: Broadband reversal of optical binding force

ABSTRACT

The behavior between the chiral –plasmonic nanoparticles and their optical binding force in near and far field has not been investigated in the literature yet. There is no generic way to reverse the far field optical binding force for chiral and plasmonic (sphere) heterodimers. Also the behavior of Fano resonance and the reversal of far field optical binding force of chiral plasmonic heterodimers with and without plasmonic substrates have not been studied so far. In this article, for chiral and plasmonic heterodimers, we have demonstrated a general way to control the reversal of far field binding force. However, if the chiral-plasmonic nanoparticles are located at different distance, positive and reversal of optical binding force occurs in far field. We have varied the wavelength of the dimers. We have also observed Fano resonance at both near and far field without substrate .Also while applying the same set-up over a plasmonic substrate, stable Fano resonance occurs along with the reversal of far field optical binding force. It is observed that during such Fano resonance, stronger coupling occurs between the dimers and plasmonic substrate. The reversal of optical binding force occurs near the Fano dip position. Notably, for particle clustering and aggregation, controlling the far fled binding force can be a key factor. Our proposed idea can be confirmed by simple experiment.

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