Accepted Manuscript

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 PII:
 S0030-4018(18)30827-7

 DOI:
 https://doi.org/10.1016/j.optcom.2018.09.046

 Reference:
 OPTICS 23485

To appear in: *Optics Communications*

Received date : 6 July 2018 Revised date : 31 August 2018 Accepted date : 19 September 2018



Please cite this article as: S. Chandel, et al., Mueller matrix spectroscopy of fano resonance in plasmonic oligomers, *Optics Communications* (2018), https://doi.org/10.1016/j.optcom.2018.09.046

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Mueller Matrix Spectroscopy of Fano Resonance in Plasmonic Oligomers

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Abstract

Fano resonance in plasmonic oligomers originating from the interference of a spectrally broad superradiant mode and a discrete subradiant mode is under intensive recent investigations due to numerous potential applications. In this regard _ levelopment of experimental means to understand and control the complex Fano interforence process and to modulate the resulting asymmetric Fano spectral line shape is night sought after. Here we present a polarization Mueller matrix measurement and invers⁻ analysis approach for quantitative understanding and interpretation of the complex in resonance process that lead to Fano resonance in symmetry broken plasmonic oligomera. The spectral Mueller matrices of the plasmonic oligomers were recorded using a custom drsigned dark-field Mueller matrix spectroscopy system. These were subsequently analyzed using differential Mueller matrix decomposition technique to yield the quantitative samp, polarimetry characteristics, namely, polarization diattenuation (d) and linear retarda. ce () parameters. The unique signature of the interference of the superradiant dip lar plasmon mode and the subradiant quadrupolar mode of the symmetry broken plasme, i, oligomers manifested as rapid spectral variation of the diattenuation and the linear etardance parameters across the Fano spectral dip. The polarization information contained in the Mueller matrix was further utilized to desirably control the Fano spectral line shape. The experimental Mueller matrix analysis was complemented with finite element base. In merical simulations, which enabled quantitative understanding of the interference of the superradiant and the subradiant plasmon modes and its link with the polarization diat envation and retardance parameters preparation.

Keywords: Plasr Jnics. 1 Jarization, Oligomers, Dark-Field Microscopy, Mueller Matrix.

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Preprint submitted to Optics Communication

August 31, 2018

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