Quantitative polarimetry in nano-plasmonics: biomedical prospects

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Polarization properties of light scattered from plasmon resonant metal nanoparticles / nanostructures contain wealth of information on the interaction of light with such nano scale structures, which are crucial for both fundamental understanding of the interactions and for optimizing / enhancing experimental parameters for many practical applications. However, biomedical applications (e.g, biomedical imaging and sensing) of plasmon polarimetry are confounded by numerous complexities due to scattering from biological structures and simultaneous occurrences of several polarization events in complex nano-bio composites. In order to realize the potential of polarimetry of nano-plasmonics for biomedical imaging and sensing, a number of researchers are thus pursuing innovative solutions to these challenges. In this talk, I shall briefly discuss about the recent inroads made by us pertinent to quantitative polarimetry of plasmon resonant metal nanoparticles / nanostructures. These include - (i) development of high sensitive spectral polarimetric imaging system and (ii) polarimetry inverse analysis models for extraction, quantification and unique interpretation of the individual, intrinsic polarimetry characteristics of complex systems such as nano-bio composites. In this context, the polarized light basics, namely, Jones matrix, coherency matrix, Stokes Mueller formalism will be briefly reviewed. Finally, initial results of exploration of our comprehensive polarimetry platform towards investigation of quantitative polarization characteristics of plasmon resonant metal nano-rods / nano-spheroids will be presented and the implications of these results for nanoparticle-based optical imaging, spectroscopy and sensing applications will be highlighted.