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Noble classical and quantum approach to model the optical properties of metallic nanoparticles to enhance the sensitivity of optoplasmonic sensors

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The bright light obtained from the quantum principle has a key role in the construction of optical sensors. Yet, theoretical and experimental work highlights the challenges of overcoming the high cost and low efficiency of such sensors. Therefore, we report a metallic nanoparticle-based metasurface plasmons polariton using quantum and classical models. We have investigated the material properties, absorption cross-section, scattering cross-section, and efficiency of the classical model. By quantizing light–matter interaction, the quantum features of light, degree of squeezing, correlation, and entanglement are quantified numerically and computationally. In addition, we note the penetration depth and propagation length from a hybrid model in order to enhance the optoplasmonic sensor performance for imaging, diagnosing, and early perception of cancer cells with label-free, direct, and real-time detection. The findings of this work is illustrates that the frequency of incident light, size, shape, and type of nanoparticles has a significant impact on the optical properties of metallic nanoparticles and the nonlinear optical properties of metallic nanoparticles are dynamic, enhancing the sensitivity of the optoplasmonic sensor. Moreover, the resulting bright light shows the systematic potential for further medical image processing.

Biography

Alemayehu Getahun obtained his first degree in Physics from Debre Birhan University in 2015 and his MSc degree from Hawassa University in Quantum Optics (2018). Currently he is a PhD candidate of Laser Spectroscpy and Quantum information at Adama Science and Technology University and Guest lecturer at Adama General Hospital and Medical College. He has published more than 5 papers in reputed journals.