Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **343** Type: **Oral not-in-competition (Graduate Student) / Orale non-compétitive (Étudiant(e) du 2e ou 3e cycle)**

Kerr Nonlinearity and Energy Transport in Quantum Dots and Metallic Nanoparticles

Wednesday 9 June 2021 16:58 (3 minutes)

Recently, there has been considerable interest to study the nonlinear properties of ensembles of metallic nanoparticles and quantum dots [1,2]. Nonlinear optical properties can be used for processing the information content of data images, on which the research can potentially induce a revolution in electronic as well as photonic nanotechnology and nanomedicine. We have studied the energy transport due to the Kerr nonlinearity in plasmonic nanohybrids. The Kerr coefficient has been calculated by using the quantum density matrix method in the dipole-dipole coupling between quantum dots. Induced dipoles are created when the probe photon falls on the metallic nanoparticles. These metallic nanoparticles interact with each other via dipole-dipole interaction. We showed that the power is transferred from the metallic nanoparticles to the quantum dots through surface plasmon polaritons. During this process, enhancement in the energy transfer in the quantum dots is found. We have also predicted that the power spectrum peak would split into two peaks due to the strong coupling between excitons and the dipole-dipole interaction. Considering one peak as ON position and two peaks as OFF position, the present findings can be applied to fabricate nanoswitches. The Kerr nonlinear plasmonics in metallic nanohybrids can also be used for medical applications since there will be no damaging effect on the body.
[1] J Guo, K Black, J Hu, M Singh, Journal of Physics: Condensed Matter 30 (18), 185301 (2018).
[2] M.R. Singh; Phys. Rev. A102, 013708 (2020).

Authors: FANG, Ningyan (University of Western Ontario); SINGH, Mahi (Western)

Presenter: FANG, Ningyan (University of Western Ontario)

Session Classification: W4-2 Theory and Condensed Matter (DTP/DCCMP) / Théorie et matière condensée (DPT/DPMCM)

Track Classification: Theoretical Physics / Physique théorique (DTP-DPT)