Towards quantum plasmonics: plasmon mediated qubit-qubit entanglement

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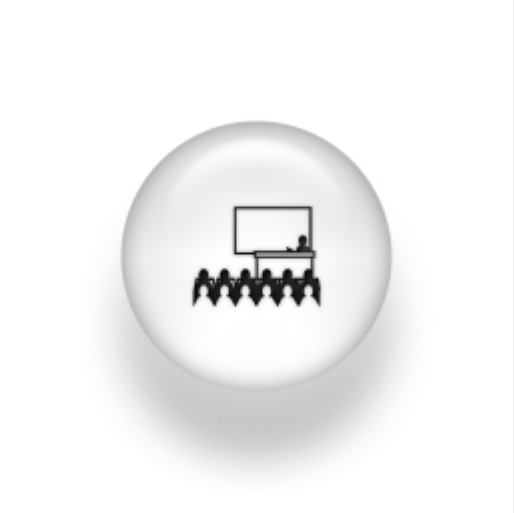

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ABSTRACT:
The field of nanoplasmonics has received an extraordinary attention in the last few years due to the prediction of a lot of interesting physical phenomena such as extraordinary optical transmission, enhanced energy transfer, surface plasmon sensors and many more [1].
All these phenomena can be obtained from a classical description of the field, however there have been a few steps in exploring its quantum regime,i.e., generating single plasmons [2] using nanowires. Our way to quantum plasmonics started studying the dissipative dynamics of a single emitter close to a metal-semiconductor interface [3]. After the proposal of coupling two qubits through plasmonics one-dimensional nanowaveguides [4], we have studied the possibility of coupling two qubits by plasmons supported by them. The plasmons induce coherent and incoherent coupling between the qubits, dephased π/2 between them, allowing us to switch off one of the two contributions while maximising the other by altering the interqubit distance. Mainly due to the dissipative component of this coupling we could find situations of spontaneous formation of entanglement and using a laser a stationary entangled state appears for distances larger than the operating wavelength [5].
[1] F.J Garcia-Vidal et al, Rev. Mod. Phys. 82, 729 (2010)
[2] A. Akimov et al. Nature 450, 402 (2007)
[3] A. Gonzalez-Tudela, Phys. Rev. B 82, 115334 (2010)
[4] D. Martín-Cano et al, Nano Lett. 10, 3129 (2010)
[5] A. Gonzalez-Tudela et al, Phys. Rev. Lett., 106, 020501 (2011). Highlighted in Physics.