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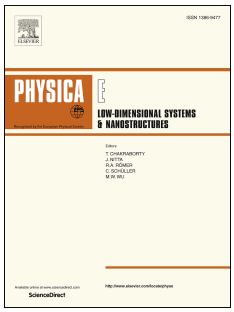

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Quantum state transfer between nitrogen vacancy centers coupled to photonic crystal molecule in the off resonant regime

Hamad Ali[a], Abdul Basit[a], Fazal Badshah[a,b], Guo-Qin Ge[a,*]

[a]*School of Physics, Huazhong University of Science and Technology, 1037 Luoyu Road, Wuchang, Wuhan, 430074, P. R. of China*
[b]*Quantum Optics Lab, Department of Physics, COMSATS Institute of Information Technology, Islamabad, Pakistan*

Abstract

We investigate the transfer of excitation in a system of two nitrogen vacancy centers (NVs) coupled to cavities of a photonic crystal molecule. The analytical results are obtained for the study of quantum state transfer in the special cases of strong coupling ($g \gg \Omega$), comparable coupling-hopping ($g\ (atom - cavity\ coupling) \simeq \Omega\ (hopping\ between\ cavities)$) and large hopping ($g \ll \Omega$) in the presence of detuning and decoherence. In comparable coupling-hopping case, presence of detuning compresses the otherwise equally competitive local oscillations in process of remote quantum state transfer between the two nitrogen vacancy centers. In strong coupling limit $g \gg \Omega$, evolution of the system may be viewed due to two loosely coupled subsystems described by Jaynes-Cummings model. Here, the state transfer rate and its amplitude are mainly controlled by the coupling strength (g) of the nitrogen vacancies with their respective cavities. For the large hopping case, we notice very weak excitation probabilities of the cavity modes which is crucial for minimization of decoherence of the system. Interestingly, in this limiting case, frequency of the state transfer increases with the increase in detuning between NVs and its respective cavity mode.

Keywords: Quantum state transfer, Nitrogen vacancy center, Photonic crystal, Quantum information processing

*Corresponding author
Email address: gqge@hust.edu.cn (Guo-Qin Ge)