

# QUANTUM PHYSICS AND QUANTUM TECHNOLOGY

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## Properties and Non-extensive Entropy of polaron in RbCl delta quantum dot under an applied electric field and Coulombic impurity

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**B**ound polaron in RbCl delta quantum dot under electric field and Coulombic impurity was considered and the ground and first excited state energy were derived employing the combining Pekar variational and unitary transformation methods. Applying Fermi golden rule, the expression of temperature and polaron lifetime are derived. The decoherence was studied through the Tsallis entropy. Results showed the decreases (increases) of lifetime with the increases (decreases) of temperature and delta parameter (electric field strength and hydrogenic impurity) suggesting that to accelerate quantum transition in nanostructure, temperature and delta have to be enhance; while with the improvement of electric field and coulomb parameter, the delta quantum dot qubit lifetime increases. Energies spectrum of polaron increase with temperature, electric field strenght, Coulomb parameter, delta parameter and polaronic radius. The control the delta quantum dot energies can be done via the electric field, coulomb impurity and delta parameter. Results also show that the non-extensive entropy is an oscillatory function of time. With the enhancement of delta parameter, non-extensive parameter, Coulombic parameter and electric field strength, the entropy has a sinusoidal increase behavior with time. With the study of decoherence through the Tsallis entropy, it may be advised that to have a quantum system with efficient transmission of information the non-extensive and delta parameters need to be significant. The study of the probability density showed an increases from the boundary to the center of the dot where it has its maximum value and oscillate with period with the tunneling of the delta parameter, electric field strength and Coulombic parameter. The results may be very helpful in the transmission of information in nanostructures and control of decoherence.

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