Coherent Manipulation of a Binary Atomic System with Gain

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Abstract

We analytically study the optical response of a binary atomic system with one of them excited by an incoherent pump and continuous illumination provided by a quasi-resonant beam [1]. This study allows us to analyze and eventually optimize the coherent manipulation of the system while preserving the fundamental quantum properties, i.e., entanglement, superposition and coherence by executing operations by applying lasers on atoms trapped in optical tweezers [2]. Using a schematic representation, we identify all radiative processes to describe those configurations in which incoherent effects, such as absorption and spontaneous emission processes, can be neglected in the middle and far-field regime. On the other hand, we identify those processes that, by breaking the parity symmetry, imply the directionality of the emission and determine the asymmetric transfer of the excitation. In subsequent work, this study will be extended to chains of neutral atoms through numerical simulations, with the aim of optimizing the scalability of multi-atom qubits [3].

References

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