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Interaction of a three-level atom and a field with a time-varying frequency in the context of triangular well potentials: An exact treatment (Article)

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Abstract

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We introduce a model of interaction between a three-level atom (3LA) and a one-mode field whose frequency evolves with the time in the context of triangular potentials. We consider a new class of cat states described as a superposition of the coherent states that are associated with these kinds of potentials. Mathematical and physical consequences of the obtained results are analyzed and discussed in detail by using the exact analytical treatment of the quantum system-state at subsequent times. We investigate the nonlocal and nonclassical properties of different system states in terms of the main parameters of the model. Interestingly, we present the dynamical behavior of the entanglement, second order correlation function, quantum Fisher information, and geometric phase of the considered bipartite quantum system. We show that the physical quantities for the proposed scheme are very sensitive through the choice of the time-varying frequency of the fields, at either coherent states or their superposition, and we compare the results to the case of fields that are associated to harmonic well potentials. Finally, we explore the relationship and dependence of the physical quantifiers on the main parameters of the model. © 2020 Elsevier Ltd

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