Iranian Journal of Physics Research, Vol. 23, No. 2, 2023
DOI: 10.47176/ijpr.23.2.61705

Investigating and analysis of the properties of coherent states of a deformed nonlinear harmonic oscillator

M Daeimohammad[1] and M Nili Ahmadabadi[2]

1. Department of Physics, Faculty of Computer Engineering, Najafabad Branch, Islamic Azad University, Najafabad, Iran
2. Department of Mathematics, Faculty of Computer Engineering, Najafabad Branch, Islamic Azad University, Najafabad, Iran

E-mail: m.daeimohammad@pco.iaun.ac.ir

(Received 27 June 2023 ; in final form 11 August 2023)

Abstract

In this research, we study the coherent states of a deformed nonlinear harmonic oscillator. We use the perturbation theory to compute eigenstates and eigen-values for a deformed nonlinear harmonic oscillator and then define the generalized coherent states based on the Gazeau-Klauder formulation. Then, using the Mandel parameter and the second-order correlation function, we will investigate the statistical properties of the system. The analysis shows that the coherent states for a deformed and non-deformed nonlinear harmonic oscillator follows the sub-Poissonian and super-Poissonian statistics, and exhibits the antibunching and bunching effects, respectively. In addition, we show that the anti-correlation function for a deformed nonlinear oscillator is strongly fluctuating and irregular. Also, the anti-correlation function of a non-deformed nonlinear harmonic oscillator shows the phenomena of collapse and revival of fractional revelations. We also examine the limits of different parameters so that the obtained results are valid.

Keywords: deformed nonlinear harmonic oscillator, coherent states, Mandel parameter, super-Poissonian and sub-Poissonian statistical distributions, the bunching and antibunching effects

For full article, refer to the Persian section