

Document details

< Back to results | 1 of 1

Export Download Print E-mail Save to PDF Add to List More... >

[Full Text](#) View at Publisher

Optik
Volume 157, March 2018, Pages 1035-1052

Squeezing , mixed mode squeezing , amplitude squared squeezing and principal squeezing in a non-degenerate parametric oscillator (Article)

Alam, M.^a, Mandal, S.^a, Wahiddin, M.R.^b

^aDepartment of Physics, Visva-Bharati, Santiniketan, India

^bDepartment of Computer Science, Kuliyah of ICT, International Islamic University Malaysia, Kuala Lumpur, Malaysia

Abstract

[View references \(59\)](#)

The Hamiltonian and hence the equation of motion of the field operators of a non-degenerate parametric oscillator (NDPO) under the influence of classical pump are formulated. The coupled operator differential equations involving the signal and idler modes are decoupled at the expense of fourth order differential equations involving the c-numbers. Without using the rotating wave approximation, the analytical solutions of the field operators are obtained. These solutions are approximated up to the second orders in dimensionless coupling constant. We investigate the squeezing, mixed mode squeezing, amplitude-squared squeezing, and the principal squeezing of the thermal and coherent light coupled to the NDPO. By using the input composite number state, we establish that the percentage and the range (interaction time) of squeezing is considerably increased with the increase of the signal photon number. For initial composite number state, the amplitude squared squeezing for Y_s quadrature is obtained at the cost of canonically conjugate Z_s quadrature. The percentage of amplitude squared squeezing increases significantly with the increase of signal excitation (photon). The so-called normal squeezing and the principal squeezing are also indicated for the NDPO coupled with the initially prepared composite coherent states not in the composite number states. In spite of the shortcomings of the analytical solutions, we obtain squeezing, amplitude squared squeezing and other nonclassical effects which are unavailable under the rotating wave approximation. In order to give the feelings about the analytical results (expressions), we give some symbolic calculations relevant to the possible experimental situations. © 2017 Elsevier GmbH

Author keywords

Mixed mode squeezing Nondegenerate parametric oscillator Principal squeezing Rotating wave approximation Squeezing

Indexed keywords

Engineering controlled terms: Coherent light Differential equations Equations of motion Hamiltonians Photons Quantum optics

Compendex keywords: Mixed mode Nondegenerate Principal squeezing Rotating wave approximations Squeezing

Engineering main heading: Parametric oscillators

Funding details

Funding number Funding sponsor Acronym Funding opportunities

Metrics

0 Citations in Scopus
0 Field-Weighted Citation Impact



PlumX Metrics

Usage, Captures, Mentions, Social Media and Citations beyond Scopus.

Cited by 0 documents

Inform me when this document is cited in Scopus:

[Set citation alert >](#)

[Set citation feed >](#)

Related documents

Quantum phase fluctuations of coherent and thermal light coupled to a non-degenerate parametric oscillator beyond rotating wave approximation

Alam, M. , Mandal, S. , Wahiddin, M.R. (2017) *Optics Communications*

Nonclassical properties of coherent light in a pair of coupled anharmonic oscillators

Alam, N. , Mandal, S. (2016) *Optics Communications*

Amplitude-squared and amplitude-cubed squeezing in stimulated Raman and in spontaneous Raman scattering

Sen, B. , Mandal, S. (2008) *Journal of Modern Optics*

[View all related documents based on references](#)

[Find more related documents in Scopus based on:](#)

Funding number	Funding sponsor	Acronym	Funding opportunities
F.No.42-852/2013(SR)	University Grants Commission	UGC	
	Council of Scientific and Industrial Research	CSIR	See opportunities by CSIR

Funding text

One of the authors (SM) thanks the University Grants Commission , New Delhi for financial support through a major research project (F.No.42-852/2013(SR)). SM also thankful to the Council of Scientific and Industrial Research (CSIR) , Government of India for financial support (03(1283)/13/EMR-II).

ISSN: 00304026

Source Type: Journal

Original language: English



DOI: 10.1016/j.ijleo.2017.11.113

Document Type: Article

Publisher: Elsevier GmbH

References (59)

[View in search results format >](#)

All [Export](#)  Print  E-mail [Save to PDF](#) [Create bibliography](#)

1 Butcher, P.N., Cotter, D.
The Elements of Nonlinear Optics
(1991) . Cited 1141 times.
Cambridge University Press New York, NY, USA

2 Boyd, R.W.
Nonlinear Optics
(2006) . Cited 6778 times.
2nd ed. Academic Press New York

3 Yariv, A.
Quantum Electronics
(1988) . Cited 4466 times.
3rd ed. John Wiley & Sons New York

4 Ban, M.
Generation of a single-mode squeezed state via a non-degenerate parametric amplifier

(1997) *Physics Letters, Section A: General, Atomic and Solid State Physics*, 233 (4-6), pp. 284-290. Cited 15 times.
doi: 10.1016/S0375-9601(97)00514-8

[View at Publisher](#)

5 Perina, J., Hradil, Z., Jurco, B.
Quantum Optics and Fundamentals of Physics
(1994) . Cited 122 times.
Kluwer Academic Publishers Dordrecht

6 Ficek, Z., Wahiddin, M.R.B.
Quantum Optics: Fundamentals and Applications
(2004) . Cited 9 times.
International Islamic University Malaysia Kuala Lumpur