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Construction of a q-deformed Hilbert Space to analyze some deformed states in Quantum Optics

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abstract: In this paper we construct a q-deformed Hilbert space and define annihilation and creation operators to generate deformed states. We show that these states are useful to throw some insight in the theory of Quantum Optics.

1 Introduction:

Coherent states associated with various dynamical symmetry groups are important in many problems of quantum physics. Glauber's coherent states[17] of simple harmonic oscillator and coherent states of various Lie algebras[18], due to Perelomov, are useful in the study of quantum optics. There are three basic ways one can generate coherent states which refer to vectors in a finite or infinite dimensional Hilbert space. In the first approach, Glauber defined coherent states as the right-hand eigenstates of the non-Hermitian boson annihilation operator of the radiation field. In the second approach, the coherent states are generated from vacuum by the action of the so called unitary displacement operator, that is, they are displacement operator states. This is also known as the group theoretic approach to generate coherent states. In the third approach,the coherent states can be defined as states that minimize Heisenberg uncertainty relation, or, simply as minimum uncertainty states.

We adopt the first approach to generate coherent vectors of a backwardshift acting on a deformed Hilbert space.This gives a generalisation of coherent states, as an eigenstate of photon annihilation operator, which are studied in various contexts of quantum optics.

To deal with the fluctuating fields we introduce a distribution for the complex field amplitude in classical coherence theory. By integrating over the strength of the field we then obtain the phase distribution. The description of the phase in quantum mechanical terms has been influenced by the difficulty of ascribing an operator to it in the quantum sense. To define a Hermitian phase operator in