

# Quantum Theory of Optical Coherence

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WILEY-VCH

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### Selected Papers and Lectures

It is convenient to allow  $P(\alpha)$  to have delta function singularities so that we may think of a pure coherent state as represented by a special case of Eq. (7.7). A normalized two-dimensional delta function which is suited to this purpose may be defined by

$$\delta(\alpha) = \delta(2\pi\alpha) / (2\pi\alpha),$$

The pure coherent state is then completely described by

$$P(\alpha) = \delta^2(\alpha - \beta),$$

and the ground state of the oscillator is specified by setting  $\beta = 0$ . The density operator  $\rho$  which corresponds to Eq. (7.3) is a superposition of the projection operators (7.1)

$$\rho = \int P(\alpha) | \alpha \rangle \langle \alpha |.$$

It is the kind of operator we might naturally be led to if we were given knowledge (through oscillator in a different state, but one which corresponds to an unknown eigenvalue  $\alpha$ ) that function  $P(\alpha)$  might then be thought of as playing a role analogous to a probability density for the distribution of values of  $\alpha$  over the complex plane. Such an interpretation may, as we shall see, be justified actually. In general, however, it is not possible to interpret the function  $P(\alpha)$  as a probability distribution in any precise way since the projection operators  $| \alpha \rangle \langle \alpha |$  with which it is associated are not orthogonal to one another for different values of  $\alpha$ .

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出版者:John Wiley & Sons Inc

出版时间:2007-3

装帧:HRD

isbn:9783527406876

A summary of the pioneering work of Glauber in the field of optical coherence

phenomena and photon statistics, this book describes the fundamental ideas of modern quantum optics and photonics in a tutorial style. It is thus not only intended as a reference for researchers in the field, but also to give graduate students an insight into the basic theories of the field. Written by the Nobel Laureate himself, the concepts described in this book have formed the basis for three further Nobel Prizes in Physics within the last decade.

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