SUPERSYMMETRY AND COHERENT STATES

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ABSTRACT

This contribution describes the recently introduced notion of supercoherent states and their possible use in physics. It must be understood as a critical overview of a quite new subject.

. Introduction

Since the emergence of supersymmetry in physics, many known techniques have been extended to the supersymmetric context. Hence notions such as supergroups and superalgebras are now widely used by both physicists and mathematicians. Their applications in physics range from the simple invariance properties to the spectrum generating superalgebras [1]. The main idea behind the introduction of supersymmetry is based on the fact that it allows mixing bosons and fermions. This theory is not so old, one can trace back its appearance to the sixties though the recent physical interest increased since Witten's supersymmetric quantum mechanics (SSQM) was introduced in the early 80's [2].

The supersymmetric (susy) extension of the usual (non super) concepts is still under investigation. One of the recent and promising extension is the notion of supercoherent states [3-5]. The aim of this paper is twofold. First we will discuss how this new notion actually arises as a natural supersymmetric extension of the Perelomov coherent states [6]. Then we will explore the relevance of such supercoherent states for the study of a non-trivial physical model, namely the Jaynes-Cummings (JC) model [7]. The latter is a celebrated model in quantum optics. Its most attractive feature is its complete integrability. In its simplest version, it describes the interaction of cavity mode with a two-level system.

As we said in the abstract, we adopt here an approach which is mainly descriptive and (we hope) critical. We will soon report on a more original contribution [8]. In order to fix the definitions and the notations we will first consider the most simple model, namely the supersymmetric harmonic oscillator and its supercoherent states [3] [5]. We will then discuss the JC model, which differs from the previous system by the presence of a Bose-Fermi interaction.

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