GREEN'S FUNCTION FOR CROSSED TIME-DEPENDENT ELECTRIC AND MAGNETIC FIELDS PHASE-SPACE QUANTUM MECHANICS APPROACH

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ABSTRACT

The Moyal propagator is obtained for an electron inmersed in a constant uniform magnetic field crossed with a uniform electric field having arbitrary time dependence, using the techniques of phase space quantum mechanics. All the interesting magnitudes can be evaluated from it, and one can make quantum physics remaining in the context of phase space. Using these methods, the corresponding Green's function is obtained.

Introduction

The origins of the phase–space approach to quantum mechanics are quite old [1–4]. In cent times some papers have been published setting up on a new basis both, the nonrelativistic eatement [5–12] and the relativistic one [13]. In particular, we can now include spin in the non–lativistic phase–space description. Working in this context, we are going to apply some of the chniques recently developped in this field to evaluate some functions of physical relevance, for the se of having a spinning particle immersed in a quite general external electromagnetic field.

It is remarkable that the nonrelativistic Green's function for crossed magnetic field and bitrarily varying electric field has only recently been derived [14], by using the method introduced Schwinger in quantum electrodynamics forty years ago. This is obtained again here as a byproduct quite a different approach: the phase space formalism. As we will see, our results are free from e inconsistencies that affect those of Morgenstern *et al* [14]. Some other examples have been nsidered by Malkin *et al* [16–17, and references of the same authors quoted therein]; they evaluated e Green's function for a different electromagnetic field using the coherent–state representation of e corresponding time–dependent Hamiltonian.

The organization of the paper is as follows. In section 2 we recall the basic ideas and formulae nonrelativistic quantum mechanics in phase space. The relevance of quadratic Hamiltonians is ade clear.

We devote section 3 to evaluate the Moyal propagator, the keystone of this treatement, for particle inmersed in a constant uniform magnetic field crossed with a uniform electric field having bitrary time dependence. This will enable us to perform the standard calculations of quantum

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