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# GEOMETRIC QUANTIZATION OF A PARTICLE IN A PERPENDICULAR MAGNETIC FIELD

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**Abstract.** In this paper we develop the quantization of a particle in the plane under the influence of a perpendicular magnetic field using the geometric quantization with half–forms in Hilbert space of holomorphic functions. An original coordinate transformation is applied to convert the problem into a system of harmonic oscillators. Then, it is solved highlighting the relationship between different representations. We emphasize the isomorphism between the holomorphic representation and the Schrödinger representation.

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## 1. Introduction

Geometric quantization is a well established theory (see for example [5, 11, 15, 16, 22,25,27,31]), and it is useful in the choice of coordinates and other structures such as operators, Hilbert spaces and isomorphisms between different representations.

The system studied here is a particle in a plane under the influence of a perpendicular magnetic field. This system provides the basis for analyzing other phenomena such as the quantum Hall effect [20] or the study of anyons [30]. The same system was studied in [4] with a completely different approach. Also, a different approach to the holomorphic quantization of a particle in a magnetic field is presented by Hall and Kirwin [14] or Dunne [6].

The following section briefly explains the theory of geometric quantization. We state the main ideas that lead to the quantization with half–forms, without extensive developments and demonstrations which can be found in the reference section.Then a model consisting of a charged particle moving in a plane under the influence of a perpendicular magnetic field is developed. Special emphasis is placed on the original choice of coordinates, the complex structure and description of the Hilbert space. In the literature we can find interesting examples of complex problems solved through a specific coordinate transformations [7].