Bulletin de la Société Royale des Sciences de Liège, 53e année, 3-4, 1984, pp. 187-192

CONSTANTS OF MOTION OF CHARGED MESONS WITH CLASSICAL INTERACTIONS *

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RESUME

Nous étudions les formalismes hamiltonien et lagrangien décrivant des mésons scalaires (et vectoriels) plongés dans un champ électromagnétique extérieur. L'ensemble complet des constantes du mouvement est obtenu en utilisant la description relativiste de Sakata-Taketani.

1. INTRODUCTION

We recently discussed (Beckers and Hussin, 1984) the full set of constants of motion characterizing relativistic or nonrelativistic electrons interacting with (external) classical electromagnetic fields. Based on Hamiltonian and Lagrangian formalisms, such a study deals with recent gauge theoretical developments (Jackiw and Manton, 1980) and symmetries of potentials (Beckers and Hussin, 1983). Through group extensions (Bargmann, 1954) and associated extended Lie algebras, we completed the fundamental and standard approach of Johnson and Lippmann (1949). In particular, such developments exploited the U(1)-gauge theory as well as the minimal electromagnetic coupling principle.

Relativistic or nonrelativistic electrons are respectively described by the Dirac or Schrödinger equations. These are time first order descriptions whose associated Hamiltonians and Lagrangians are very well known. If the considered charged particles are (scalar or vector) mesons, the corresponding elements are not so simple : from Bhabba's equations (Bhabba, 1939) or Kemmer's formulation (Kemmer, 1939) Hamiltonian formalisms have been obtained but with extra conditions (eliminating the redundant components). The only net formalism for such mesons is the one presented by Sakata and Taketani (1940) (see also Baym, 1969) : in particular, for scalar mesons, it corresponds to a Hamiltonian version of the time second order description associated with the Klein-Gordon equation.

Here we apply our recent developments (Beckers and Hussin, 1984) to the case of scalar mesons by using the Sakata-Taketani formulation with electromagnetic interactions. We get the full set of constants of motion and manage all the difficul-

* *Présenté le 21 juin 1984.*
** *Chercheur I.I.S.N.*