General Theory for Spin 3/2 Particle in External Electromagnetic and Gravitational Fields, Constructing Solutions with Spherical Symmetry

Viktor Red'kov

National Academy of Science of Belarus, Belarus

E-mail: v.redkov@ifanbel.bas-net.by

ABSTRACT

General theory for a spin 3/2 particle in presence of external electromagnetic fields on the background of an arbitrary curved space-time, is elaborated. The 16-component equation in Rarita Schwinger basis is divided into the main equation and two constraints, algebraic and differential ones. First, this system is solved in spherical coordinates of the Minkowski space- time. There are constructed wave functions on which 4 physical operators are diagonalized: of energy, square and third projection of the total angular momentum, and space reflection. After separating the variables, the main system of 8 radial equations and additional 2 algebraic and 2 differential constraints, are derived. Their solutions are constructed in the form of linear combinations of Bessel functions, with the use of the known properties of these functions, the complete system of equations is transformed to a purely algebraic form. Ultimately, the task reduces to one linear constraints on three numer ical parameters. Any two linearly independent sets determine two different quantum states of the spin 3/2 particle. The study is extended to the case of de Sitter space-time background. Mathematical task becomes however much more complicated.