Spin 3/2 Particle in External Magnetic Field, the Method of Projective Operators, Algebraic Approach

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2023

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Keywords: spin 3/2 particle, magnetic field, projective operators, exact solutions, energy spectra.

Abstract: In the present paper, an algebraic method for solving the system of equations describing the spin 3/2 particle in presence of the uniform magnetic field has been elaborated. The method is based on decomposition of 16-components wave function with transformation properties of vector-bispinor in the sum of four constitutes, which are determined by four projective operators. With the use of formalism of elements of complete matrix algebra, the system is transformed to the form, in which only projective constituents $\Psi\pm1/2(x)$, $\Psi\pm3/2(x)$ enter. This system of equations is transformed to cylindric coordinates. On the wave functions three operators are diagonalized: the energy, the third projection of linear momentum and the third projection of the total angular momentum. After separating the variables, we derive 4 linked subsystems of equations for 16-component functions $\Psi\pm1/2(r)$, $\Psi\pm3/2(r)$. After performing needed calculations, the problem reduces to independent second order equations for

4 primary functions. This equations are solved in terms of confluent hypergeometric functions, 4 different energy spectra are found.

Источник публикации: Spin 3/2 Particle in External Magnetic Field, the Method of Projective Operators, Algebraic Approach / A. V. Bury [et al.] // Nonlinear Dynamics and Applications. – 2023. – Vol. 29. – P. 242–264.