Nonrelativistic approximation in the theory of a spin 2 particle with anomalous magnetic moment

A.V. Ivashkevich, V.M. Red'kov, A.M. Ishkhanyan
Institute of Physics, National Acad. Sci. of Belarus, Minsk, Belarus

We start with the 50-component relativistic matrix equation for a spin 2 particle in presence of external electromagnetic fields. This equation describes the particle with anomalous magnetic moment, the complete wave function consists of 2-rank symmetric tensor and 3-rank tensor symmetric in two indices. We apply the general method for performing the nonrelativistic approximation, which is based on the structure of the 50×50 matrix Γ^0 of the main equation. With the use of the 7th order minimal equation for matrix Γ^0, we introduce three projective operators. They permit us to decompose the complete wave function into the sum of three parts, one is large, and two other are small in nonrelativistic approximation. We have found independent 5 large variables, and 45 small ones. In order to simplify the task, by eliminating the variables related to the 3-rank tensor we have derived relativistic system of 2nd order equations for 10 components related to symmetric tensor, and then take into account decomposition of these 10 variables into linear combinations of large and small ones. In accordance with general method, we separate the rest energy in the wave function and specify the orders of smallness for different terms in arising equations. Further, after performing the needed calculations, we derive the system of 5 linked equations for 5 large variables. It is presented in the matrix form which has the nonrelativistic structure, where the term of additional interaction with external magnetic field through 3 spin projections is presented. The multiplier before this interaction contains the basic magnetic moment and an addition due to anomalous magnetic moment. The last characteristics is a free parameter of the theory. The final form of this nonrelativistic equation is $i(\partial_t + ieA_0)\Psi = -\frac{1}{2M}\Delta L + \frac{e}{2M}(1+3A^2)(F_{23}S_1 + F_{31}S_2 + F_{12}S_3)\Psi$. where S_i are 5-dimensional spin matrices, F_{ij} stands for external magnetic field, and A^2 is an arbitrary parameter; at $A=0$, this equation refers to spin 2 particle without anomalous magnetic moment.

Simulation of short-range interaction by means of composition of pseudoharmonic potentials

V.V. Kudryashov, A.V. Baran
Institute of Physics, National Acad. Sci. of Belarus, Minsk, Belarus

The spherically symmetric short-range interaction for the physical system with a finite number of discrete energy levels is simulated with the help of smooth confinement potential of new type which is constructed by means of composition of pseudoharmonic potentials. The exact wave functions and energy levels are found. The dependence of energy spectrum on potential parameters is investigated.

On the tensor analyzing power component T_{20} for the reaction of incoherent neutral pion photoproduction on the deuteron in Δ-resonance region

Alexander Fix, Viacheslav Gauzshtein, Elena Kokoulina, Michael Levchuk, Maxim Nevmerzhitsky, Roman Shulyakovsky
Institute of Applied Physics NAS of Belarus, Minsk, Belarus

In the framework of the diagrammatic approach, we calculate the tensor analysing power component T_{20} for the reaction $\gamma d \to \pi^0 np$ in Δ-resonance region. The contribution of diagrams corresponding to the plane-wave impulse approximation, nucleon-nucleon final state interaction, and pion-nucleon final state interaction is taken into account. We present a comparison of our predictions with other theoretical results and corresponding experimental data.

Cylinder with a spherical defect of the "discontinuity" type in an external magnetic field

Alexei Shaplov, Alexander Garkun, Maxim Nevmerzhitsky, Roman Shulyakovsky
Institute of Applied Physics NAS of Belarus, Minsk, Belarus

We consider a cylinder in an external magnetic field with uniform magnetization along the axis of the cylinder and with an arbitrarily located small spherical defect of the discontinuity type. We obtain