Spinless Particle with Darwin–Cox Structure in External Coulomb Field

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Abstract: Generalized Klein–Fock–Gordon equation for a spinless particle with the Darwin–Cox structure, which takes into account distribution of the electric charge of the particle inside a finite spherical region is studied in presence of the external Coulomb field. There are constructed exact Frobenius type solutions of the derived equations, convergence of the relevant power series with 8-term recurrent relations

is studied. As analytical quantization rule is taken so-called transcendency conditions. It provides us with a 4-th order algebraic equation with respect to energy values, which has four sets of roots. One set of roots, $0 < E_{n,k} < 1$, depending on the angular momentum $n = 0,1,2,...$ and the main quantum number $n = 0, 1, 2, . . .$ may be interpreted as corresponding to some bound states of the particle in the Coulomb field. In the same manner, a generalized nonrelativistic Schrodinger equation for such a particle is studied, the final results are similar.

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