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SPIN 1/2 PARTICLE WITH THE ANOMALOUS MAGNETIC AND ELECTRIC DIPOLE MOMENTS, THEORIES WITH ONE AND THREE MASS PARAMETERS

In [1], staring from the general formalism by Gel'fand-Yaglom [2], it was introduced a P-asymmetric wave equation for a spin 1/2 particle with the anomalous magnetic moment (in fact, this theory describes the particle with electric dipole moment). In [1], this equation was studied in presence of external Coulomb field, but for simplicity additional interaction due to electric dipole moment was removed, so in [1] only possible manifestation of P-asymmetry was tested. Concerning the theory of the P-symmetric equation for a particle with anomalous magnetic moment see [3–8]; it is Petras [9] who first developed this theory within the general approach by Gel'fand-Yaglom.

The present paper is organized as follows. In section II study solutions of equation for the P-asymmetric particle (referring to electric dipole moment) in presence of external magnetic fields. It turns out that the energy spectra are the same as for P-symmetric particle (referring to anomalous magnetic moment).

To clarify this coincidence, in section III we demonstrate that there exists simple transformation relating these to models, by which one wave equation can be reduced to the form of other, correspondingly the function Ψ transforms to new one Ψ'; and expressions for operator of P-reflection are different in these two bases.

In section IV, we extend this approach the model, in which both sectors, P-symmetric and P-asymmetric, are presented. The main result is the same: there exists simple transformation (more general than in the above) relating P-symmetric model and that with two sectors, and expres-

sions for wave functions and operators of P-reflection are different in these two bases. We demonstrate that in presence of external uniform magnetic field, the energy spectra it the model with two sectors, indeed coincide with those in P-symmetric theory.

In section V, we develop general theory for P-asymmetric model within the basic Petras approach. In section VI we develop general theory for model with two sectors within the basic Petras approach.

In section VII we extend the known theory for a free fermion with three mass parameters [10–20], to the model with presence of two sectors, P-symmetric (referring to anomalous magnetic moment) and P-asymmetric (referring to electric dipole moment). In the section VIII we generalize this theory so that to take into account the presence of external electromagnetic field.

Thus, the present paper we study solutions of equation for the P-asymmetric particle in presence of external magnetic fields. It turns out that the energy spectra are the same as for P-symmetric particle. To clarify this coincidence, we demonstrate that there exists simple transformation relating these to models, by which one wave equation can be reduced to the form of other, correspondingly the function Ψ transforms to new one Ψ'; and expressions for operator of P-reflection are different in these two bases. We extend this approach the model, in which both sectors, P-symmetric and P-asymmetric, are presented. The main result is the same: there exists simple transformation (more general than in the above) relating P-symmetric model and that with two sectors, and expressions for wave functions and operators of P-reflection are different in these two bases. We demonstrate that in presence of external uniform magnetic field, the energy spectra it the model with two sectors, indeed coincide with those in P-symmetric theory. We develop general theory for P-asymmetric model within the basic Petras approach. In section VI we develop general theory for model with two sectors within the basic Petras approach. And finally, we extend the known theory for a free fermion with three mass parameters, to the model with presence of two sectors, P-symmetric and P-asymmetric. Also, we generalize this theory so that to take into account the presence of external electromagnetic fields.

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