Spin 1/2 Particle with the Anomalous Magnetic and Electric Dipole Moments, Theories with One and Three Mass Parameters

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Abstract: Previously, within the Gelfand - Yaglom formalism, it was introduced a P-asymmetric wave equation for a spin 1/2 particle with the anomalous magnetic moment; this theory describes the particle with electric dipole moment. This equation was studied in presence of external Coulomb field, but for simplicity additional interaction due to

electric dipole moment was removed, so only possible manifestation of P -asymmetry was tested. It is Petras who first developed P-symmetric theory for particle with anomalous magnetic moment within the general approach by Gel'fand -Yaglom.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 simpletransformation (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 in 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.