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On Modeling Neutrinos Oscillations by Geometry Methods in the Frames of the Theory for a Fermion with Three Mass Parameters

In the paper, starting from the general Gel'fand-Yaglom approach, we develop the theory of a new wave equation for a spin 1/2 fermion, which is characterized by three mass parameters. On the base of a 20-component wave function, three auxiliary bispinors are introduced, in absence of external fields these bispinors obey three separate Dirac-like equations with different masses. It is shown that in presence of external electromagnetic fields or gravitational non-Euclidean background with a non-vanishing Ricci scalar curvature, the main equation is not split into separated three equations, instead a quite definite mixing of three Dirac-like equations arises. It is shown that for Majorana particle, a generalized equation with three mass parameters exists as well. Such a generalized Majorana equation is not split into three separated equations in the curved space-time background, if the Ricci scalar of that space-time does not vanish. We have studied in detail the Majorana case, assuming approximation when an external cosmological background is taken into account by a constant Ricci parameter, R = const , and the Cartesian coordinates are used. With the help of a special linear transformation, the system of three linked Majorana equations is split into three separate ones, with modified mass parameters, the last are solved in the usual way. The spectrum of arising mass parameters is studied analytically and numerically.

Keywords: Gen Gel'fand-Yaglom approach, Dirac-like equation, wave equation, three mass parameters, electromagnetic field, curved space-time, neutral Majorana equation.