

Fradkin Equation for a Spin 3/2 Particle in Electromagnetic and Gravitational Fields

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2023

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Ключевые слова: Lorentz group, extended set of representations, generalized wave equation, fermion, intrinsic electromagnetic structure, external fields, curved space-time.

Аннотация: Many year ago, a special generalized equation for a spin 3/2 particle, different from Pauli–Fierz and Rarita–Schwinger model, was proposed by Fradkin. To the presenttime it is not clear which additional structure underlies this extended wave equation. We investigate this model systematically, applying the general Gel'fand–Yaglom formalism. Having used a standard set of requirements: relativistic invariance, singlenonzero mass and single spin $S=3/2$, P-symmetry, existence of Lagrangian formulation for the model, we derive a set of spinor equations. The 20-component wave function consists of bispinor and vector-bispinor. It is shown that in the free case

the Fradkin equation reduces to minimal Pauli–Fierz and Rarita–Schwinger equation for a bisbinor. In presence of external electromagnetic fields, the minimal form the Fradkin equation for a bispinor function contains an additional interaction term governed electromagnetic tensor. Finally we take into account the external curved space-time background, in generally covariant case the Fradkin equation

contains additional gravitational interaction through the Ricci tensor. If the electric charge of the particle is zero, the Fradkin model remains correct and describes a neutral spin $3/2$ particle of Majorana type interacting additionally with geometrical background by means of the Ricci tensor.

Fradkin Equation for a Spin $3/2$ Particle in Electromagnetic and Gravitational Fields / Kisel V. V. [et al.] // Future of Relativity, Gravitation, Cosmology. – New York : Nova Science Publishers Inc., 2023. – Chapter 14. – P. 291–316.