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Transformation properties of electromagnetic field strength quantities under local gauge U(1) symmetry described in two-spinor language and induced zitterbewegung (trembling motion) in spin 1/2 particles

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After a brief discussion about classical local U(1) gauge invariance in Weyl two-spinor form (in terms of the electric and magnetic field strength components) and the associated two spinor equations equivalent to the Lorentz force equation of electrodynamics. The local U(1) gauge transformation properties of the different components of the symmetric second order electromagnetic field spinor are analyzed. It is found that only the third component of the magnetic field is changed by local gauge transformations. Using the gauge freedom associated with the third component of the magnetic field and choosing an specific gauge (in a somewhat similar manner as the familiar Coulomb gauge in QED) it is shown that the phenomenon of zitterbewegung (trembling motion) appears in a natural way as internal motion with the velocity of light applicable to any one-half spin particle thus suggesting a kinematic origin of its rest mass and helicity. This result is in sharp contrast with the traditional interpretation (emerging from the Dirac equation) as transitions between positive and negative energy states.

Biography

J Buitrago is a Professor of Physics at the University of La Laguna in Tenerife (Spain). He obtained his degree in Theoretical Physics at the University Complutense of Madrid and later was, during two years, in Max-Planck Institute für Astronomy (Heidelberg) with a Grant from the Max Planck Gesellschaft. His research activities have been on a wide range of disciplines such as general relativity, relativistic quantum theory, gauge theories, cosmology, some areas of astrophysics, gravitational waves and cosmology. He has imparted undergraduate and graduate courses on astrophysics, nuclear physics, general relativity, cosmology and gauge theories. He directed 5 doctoral theses and published more than 40 articles. He was also visiting fellow during six months at the University College of Cardiff as well as three months in Cambridge.

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