On the electron Hamiltonian, the mass term and its $SU(2) \times SU(2)$ - gauge symmetry structure

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Abstract

I present a novel description of the electron spin origin, its symmetry properties and related conservation laws from mathematical physics point of view, having put into background the algebraic description of the corresponding physically observed representations. There is analyzed in detail the spin structure and its crucial dependence on the $SU(2)$-symmetry properties of the related representations of the basic Clifford algebra, generated by creation-annihilation operators on the Fock space and the related chirality symmetry of the Pauli spin operators. Based on the conservation law of the spin projection on the electron momentum there is proposed a novel derivation of the Dirac Hamiltonian operator, whose Lorentz invariance is naturally related to that of the fundamental Maxwell equations, whose quanta are carriers of interaction between electrons. In this work we reanalyzed the electron spin origin in the framework both of representation of the related Clifford algebra of observable operators, generated by the electron creation-annihilation operators on the Fock space, and the electron mass problems from geometric point of view, based on the extended gauge group $(SU(2) \times SU(2)) \times U(1)$ - symmetry, applied to the classical Standard Electromagnetic Model. It was demonstrated the existence of two types of $W^{\pm}$- and Z - boson particles, forming the electron mass, simultaneously producing no Higgs boson field.

The report consists of the following chapters:

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