

Some statistical aspects of the spinor field Fermi-Bose duality

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Some new statistical aspects of the Dirac equation are under consideration. The Fermi - Bose (FB) duality of the spinor field has been mentioned at first by L. Foldy (L. Foldy, Phys. Rev., 1956, 102, 568). The extended consideration has been given in (P. Garbaczewski, Int. J. Theor. Phys., 1986 25, 1193). P. Garbaczewski proved that the Fock space over the quantummechanical Hilbert space of the particle, which is described by the spinor field, allows to fulfill the dual FB, quantization of this field. And both the canonical commutation relations (CCR) and anticommutation relations (CAR) were used for the realization of the above mentioned quantization. The dual FB quantization was illustrated for different examples and in the spaces of arbitrary dimensions. The massless spinor field was considered in details (P. Garbaczewski, Int. J. Theor. Phys., 1986 25, 1193).

In our publications the consideration of the FB duality conception of the field was extended by application of the group-theoretical approach for the problem (FB duality was often called by us as the relationship between the fields of integer and half-integer spins, see e. g. (V. Simulik and I. Krivsky, Rep. Math. Phys., 2002, 50, 315; V. Simulik and I. Krivsky, Electromag. phenomena, 2003, 3, 103, and references therein). As a first step we have considered in details the case of massless Dirac equation. Both Fermi and Bose local representations of the universal covering of proper orthochronous Poincare group, with respect to which the Dirac equation is invariant, were found. The same was realized for the slightly generalized original Maxwell equations. Recently (V. Simulik and I. Krivsky, Phys. Lett. A., 2011, 375, 2479) we were able to extend our consideration for the Dirac equation with nonzero mass.

Here we consider the dual (fermionic and bosonic) symmetries and solutions of the Dirac (Foldy - Wouthuysen) equation with nonzero mass and FB conservation laws for the spinor field (see also V. Simulik et al 2011 arXiv: math-ph, 1112.5712, 24 Dec. 2011, 12 p.). We presented in details the corresponding quantummechanical stationary complete sets of operators of FB physical quantities. It allows us to demonstrate the statistical aspect of the spinor field FB duality.