Hainzl, Christian; Lewin, Mathieu; Sparber, Christof

Existence of global-in-time solutions to a generalized Dirac-Fock type evolution equation.

(English) Zbl 1115.81026

Lett. Math. Phys. 72, No. 2, 99-113 (2005).

Summary: We consider a generalized Dirac-Fock type evolution equation deduced from no photon Quantum Electrodynamics, which describes the self-consistent time evolution of relativistic electrons, the observable ones as well as those filling up the Dirac sea. This equation has been originally introduced by Dirac in 1934 in a simplified form. Since we work in a Hartree-Fock type approximation, the elements describing the physical state of the electrons are infinite rank projectors. Using the Bogoliubov-Dirac-Fock formalism, introduced by P. Chaix and D. Iracane [J. Phys., B 22, 3791–3814 (1989)], and recently established by Hainzl-Lewin-Séré, we prove the existence of global-in-time solutions of the considered evolution equation.

MSC:

81Q10 Selfadjoint operator theory in quantum theory, including spectral analysis
35Q40 PDEs in connection with quantum mechanics
81Q05 Closed and approximate solutions to the Schrödinger, Dirac, Klein-Gordon and other equations of quantum mechanics
81V10 Electromagnetic interaction; quantum electrodynamics

Keywords:

QED; vacuum polarization; Dirac equation; Hartree-Fock model; semilinear evolution equations.

Full Text: DOI arXiv

References:

[1] Dirac P.A.M. 1934. Théorie du positron, Solvay report, 203212. Paris: GauthierVillars. XXV , 353 (reprinted in Selected papers on Quantum Electrodynamics, edited by J. Schwinger, Dover, 1958)
[2] Greiner W., Müller B., Rafelski J.1985. Quantum Electrodynamics of Strong Fields. Texts and Monographs in Physics. SpringerVerlag
[3] Hainzl, C., Lewin, M., Séré, E.. Existence of a stable polarized vacuum in the Bogoliubov-Dirac-Fock approximation, Comm. Math. Phys. to appear
[4] Hainzl, C., Lewin, M., Séré, E.. Selfconsistent solution for the polarized vacuum in a nophoton QED model, J. Phys. A. Math., Gen. to appear
[5] Hainzl C., Lewin M., Séré E.: in preparation
[6] Landau, L.D.1965. On the Quantum Theory of Fields, Pergamon Press, Oxford 1955. Reprinted in emph Collected papers of L.D. Landau, D. Ter Haar, (eds.) Pergamon Press.
[7] Schweber S. S. 1994. QED and the men who made it: Dyson, Feynman, Schwinger and Tomonaga, Princeton University Press - Zbl 0815.01011
[8] Simon B. 1979. Trace Ideals and their Applications. Vol 35 of London Mathematical Society Lecture Notes Series. Cambridge University Press - Zbl 0423.47001
[9] Thaller B. 1992. The Dirac Equation, Springer Verlag - Zbl 0765.47023

This reference list is based on information provided by the publisher or from digital mathematics libraries. Its items are heuristically matched to zbMATH identifiers and may contain data conversion errors. It attempts to reflect the references listed in the original paper as accurately as possible without claiming the completeness or perfect precision of the matching.