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Nonstandard Quantumelectrodynamics

Quantum field theory got stuck by the divergence problems in the late 1940's. The way out evolved by the renormalization theory, which for quantum electrodynamics yielded unsurpassed precision in numerically confirming experimentally measurable results. However, in the renormalized form, the theory abandoned any possible framework of a Heisenberg dynamics, induced by a mathematically well defined Hamiltonian operator over the appropriate Hilbert space ("Fock space"). Altogether, this suggests replacing the initial quantized fields, which are operator-valued distributions determining the (interaction-)Hamiltonian only as a quadratic form, by infinitely close approximations being operator valued functions in the sense of Nonstandard Analysis.

References: 1) Some nonstandard quantum electrodynamics. Helv. Phys. Acta 57, 579-609, 1984; 2) More nonstandard quantum electrodynamics. Helv. Phys. Acta 60, 881-907, 1987; 3) Asymptotic nonstandard quantum electrodynamics. J. Math. Phys. 34(5), 1692-1724, 1993