Abstract Submitted
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Quantum electrodynamics of qubits IWO BIALYNICKI-BIRULA, TOMASZ SOWINSKI, Center for Theoretical Physics, Warsaw, Poland — Powerful methods of relativistic quantum electrodynamics are applied to the study of the interaction of qubits with the quantized electromagnetic field. These methods lead to a significant progress in the study of various properties of two-level systems. The application of the tools of relativistic QED to the description of two-level system is made possible by a close analogy between the Dirac sea of filled negative-energy electron states and the occupied lower-energy state of a two-level system. Propagators, the S-matrix, and Feynman diagrams turn out to be particularly useful. In applying these tools we profit from numerous simplifications in the calculations that made the Feynman-Schwinger-Dyson approach to QED so successful. Owing to these simplifications, the calculations of higher order corrections in perturbation theory become very simple. The integration over the intermediate energies can be performed in any order of perturbation theory by the standard method of residues. The analysis is carried out for two-level atoms and for spins. In particular, the polarizability of a two-level atom is calculated in the fourth-order of perturbation theory. This calculation is made simple by the analogy with the vacuum polarization in QED. Also, the treatment of nonlinear phenomena in two-level systems by analogy with their counterparts in QED is very successful.

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