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Study of charge-conjugation invariance in quantum electrodynamics with SIM(2) symmetry

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Abstract
In this paper, we consider the four-dimensional electrodynamics with SIM(2) symmetry in a very special relativity framework. First, we examine the charge-conjugation symmetry of the action at the tree (classical) level and show that the action in this framework is charge-conjugation invariant. Then, to investigate perturbatively the preservation of charge-conjugation symmetry at the loop (quantum) level, we shall focus on one-loop graphs with an odd number of photon external lines. To this end, we use the effective action approach to obtain the general form of the photon odd-point function and study the behavior of the one and three-point function of the photon under the charge-conjugation transformation. Our analysis shows that the total amplitude of the one and three-point function vanishes and hence the charge-conjugation symmetry is preserved at the quantum level. Next, we use a non-perturbative method to show that this symmetry exists at the quantum level (to all orders) and the total amplitude of all photon's odd-point functions vanishes.

Keywords: SIM(2) symmetry, very special relativity, charge-conjugation symmetry, photon's odd-point functions

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