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On higher-order quantum corrections to the photon polarization tensor in the Schwinger model

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Abstract

In this paper, we examine the theory of quantum electrodynamics with massless fermions in two dimensions (the Schwinger model). First, we derive the effective action of the photon by integrating out the fermionic degrees of freedom. Then, using this effective action and the scattering-matrix approach, we prove that the amplitudes of all diagrams contributing to the photon polarization tensor at two- and three-loop levels vanish. Next, we demonstrate that all other quantum corrections arising from higher-order perturbations also vanish. We therefore conclude, within perturbation theory, that the photon polarization tensor, and consequently the Schwinger mass, are one-loop exact.

Keywords: Quantum electrodynamics, Schwinger, Effective action, Photon polarization tensor.

For full article, refer to the Persian section