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Gradient effects on false vacuum decay in gauge theory and general estimates

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We study false vacuum decay for a gauged complex scalar field in a polynomial potential with nearly degenerate minima. Radiative corrections to the profile of the nucleated bubble as well as the full decay rate are computed in the planar thin-wall approximation using the effective action. This allows to account for the inhomogeneity of the bounce background and the radiative corrections in a self-consistent manner. In addition to the renormalization of the couplings, we employ a gradient expansion in order to systematically construct the counterterm for the wave-function renormalization. Further advances using these techniques are presented. The full decay rate however does not rely on such an expansion and accounts for all gradient corrections at the chosen truncation of the loop expansion. The ensuing gradient effects are shown to be of the same order of magnitude as nonderivative one-loop corrections.

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