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Renormalization group flow of linear sigma model with $UA(1)$ anomaly

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Motivated by recent arguments on effective restoration of $UA(1)$ symmetry around the critical temperature in two-flavor QCD, we investigate the renormalization group flow of the $U(2)\times U(2)$ linear sigma model (LSM) with the traditional epsilon expansion. Introducing the $UA(1)$ violation, the attractive basin falling into the $O(4)$ LSM in the parameter space and its dependence on the size of $UA(1)$ violation are determined. Employing a mass-dependent renormalization scheme, we also look into how the theory with 8 degrees of freedom ($U(2)\times U(2)$ LSM) reduces the one with 4 ($O(4)$ LSM).

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