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Role of inhomogeneities in the flattening of the quantum effective potential

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We investigate the role of inhomogeneous field configurations in systems with a spontaneously broken continuous global symmetry. Textbooks tell us that the quantum effective potential of the system is flat in the thermodynamic limit. At the same time, spontaneous breaking is defined through the double limit, infinite volume at finite explicit breaking sources, which then approach zero. This defining procedure leads to a flat potential by construction, however it is incapable of accessing the flat region itself. We argue that the flatness results from inhomogeneities and demonstrate it by carrying out constrained lattice simulations in the three dimensional $O(2)$ model.

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