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Generalized Gradient Flow Equation and Its Applications

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We generalize the gradient flow equation for field theories with nonlinearly realized symmetry. We apply the method to two theories, the super Yang-Mills theory in four dimensions and the O(N) nonlinear sigma model in two dimensions. Firstly, applying the formalism to super Yang-Mills theory, we construct the supersymmetric gradient flow equation. Furthermore, choosing an appropriate modification term to damp the gauge degrees of freedom, we obtain the gradient flow equation which is closed within the Wess-Zumino gauge. Secondly, applying the formalism to the O(N) nonlinear sigma model in two dimensions, we construct the gradient flow equation in the 1/N expansion. Solving this equation in the large N limit, we show non-perturbatively that the two point function at finite flow time is free from UV divergence. We also discuss the solution for four point function in the next-to-leading order of the 1/N expansion.

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