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LeRoy Apker Award Lecture: Connecting the Holographic and Wilsonian Renormalization Groups

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Inspired by the AdS/CFT duality, we develop an explicit formal correspondence between the planar limit of a d-dimensional global gauge theory and a classical field theory in a $(d+1)$-dimensional anti-de Sitter space. The key ingredient is the identification of scalar fields in the AdS with generalized Hubbard-Stratonovich transforms of single-trace couplings of the QFT. Guided by this idea, we show that the Wilsonian renormalization group flow of these transformed couplings can match the holographic (Hamilton-Jacobi) flow of bulk fields along the radial direction in AdS. This result leads to an outline of an AdS/CFT dictionary that does not rely on string theory.