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Horizon as critical phenomenon

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We show that renormalization group flow can be viewed as a gradual wave function collapse, where an initial state associated with the action of field theory evolves toward a final state that describes an IR fixed point. The process of collapse is described by the radial evolution in the dual holographic theory. If the theory is in the same phase as the assumed IR fixed point, the initial state is smoothly projected to the final state. On the other hand, the initial state can not be smoothly projected to the final state, if the system is in a different phase. Obstructions to smooth projection appear as dynamical phase transitions, which in turn give rise to horizons in the bulk geometry. We demonstrate the connection between critical behavior and horizon in an example, by deriving the bulk metrics that emerge in various phases of the U(N) vector model in the large N limit based on the holographic dual constructed from quantum renormalization group.

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