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Qubit Regularization of Asymptotic Freedom¹ SHAILESH CHANDRASEKHARAN, HERSH SINGH, Duke University, ALEX BUSER, California Institute of Technology, TANMOY BHATTACHARYA, RAJAN GUPTA, Los Alamos National Laboratory — Qubit regularization is a method of truncating the local lattice Hilbert space while being able to reproduce the relevant continuum quantum field theory. It is an important step in designing QFTs that can be solved on a quantum computer. We provide evidence that for the two dimensional $O(3)$ sigma model we may be able to achieve asymptotic freedom with only two qubits per lattice site. In particular we reproduce the universal step scaling function of the traditional model using a carefully chosen two-qubit model, which we call a "qubit-comb." We show that our model reproduces the traditional model up to very large correlation lengths. Our method can be considered as an alternative to the well known D-theory approach.

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