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A novel nonperturbative renormalization scheme for local operators

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The gradient flow, which exponentially suppresses ultraviolet field fluctuations and removes ultraviolet divergences (up to a multiplicative fermionic wavefunction renormalization), can be used to describe real-space Wilsonian renormalization group transformations and determine the corresponding beta function. We propose a new nonperturbative renormalization scheme for local operators that uses the gradient flow and is amenable to lattice QCD calculations. We present preliminary nonperturbative results for the running of quark bilinear operators in this scheme, the perturbative matching to the MS-bar scheme, and an analysis of tree-level discretization effects in the renormalization parameters.

Primary author: MONAHAN, Chris (William & Mary)

Co-authors: Prof. SHINDLER, Andrea (Facility for Rare Isotope Beams, Physics Department, Michigan State University); HASENFRATZ, Anna (university of colorado boulder); WITZEL, Oliver (Universität Siegen); Mr RIZIK, Matthew (Facility for Rare Isotope Beams, Physics Department, Michigan State University)

Presenter: MONAHAN, Chris (William & Mary)

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