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## Gradient flow as a renormalization tool

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The Gradient Flow is a smoothing technique that has been extensively studied for its renormalization properties. When combined with the short flow-time expansion, it provides a renormalization scheme in which hadronic matrix elements on the lattice evolve with the flow time, suppressing ultraviolet (UV) divergences. In this scheme, some of the typical lattice challenges—such as operator mixing with lower-dimensional operators—are either avoided or relegated to the perturbative matching stage. I will begin by introducing the Gradient Flow methodology and provide an overview of the short flow-time expansion. I will then present our approach for determining two distinct classes of observables: (1) matrix elements of four-quark operators relevant to neutral meson mixing and meson lifetimes, and (2) renormalized quark masses.

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