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C8: Advances in lattice hadron physics calculations using the gradient flow

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Lattice calculations of hadronic observables are aggravated by short-distance fluctuations. The gradient flow, which can be viewed as a particular realisation of the coarse-graining step of momentum space RG transformations, proves a powerful tool for evolving the lattice gauge field to successively longer length scales for any initial coupling. Already at small flow times we find the signal-to-noise ratio of two- and three-point functions significantly enhanced and the projection onto the ground state largely improved, while the physics is left unchanged. A further benefit is that far fewer conjugate gradient iterations are needed for the Wilson-Dirac inverter to converge. The inverter even converges for $\kappa > \kappa_c$, which allows us to explore the Aoki phase. We expect the effect of renormalisation and mixing to be significantly reduced as well.

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