



Contribution ID: 319

Type: Oral presentation

## Implementation of Simultaneous Inversion of a Multi-shifted Dirac Matrix for Twisted-Mass Fermions within $DD_{\alpha}AMG$

Friday 30 July 2021 07:45 (15 minutes)

At physical light quark masses, efficient linear solvers are crucial for carrying out the millions of inversions of the Dirac matrix required for obtaining high statistics in quark correlation functions. Adaptive algebraic multi-grid methods have proven to be very efficient in such cases, exhibiting mild critical slowing down towards very light quark masses and outperforming traditional solver methods, such as the conjugate gradient method, at the physical point.

In this talk we will discuss our implementations of simultaneous inversion of a (degenerate) Dirac matrix for twisted-mass fermions for multiple right-hand-sides (rhs) with multi-shifts and block-Krylov solvers. The implementation is carried out within the community library  $DD_{\alpha}AMG$ , which implements aggregation-based Domain Decomposition adaptive algebraic multi-grid methods. The block-Krylov solvers are provided via the Fast Accurate Block Linear krylOv Solver (Fabulous) library and can be used at coarser levels.

Our code inverts Dirac matrices with different twisted-mass terms and for multiple rhs simultaneously and is thus also suitable for components within a typical lattice QCD simulation workflow, such as the rational approximation. We show preliminary results on scalability and compare the performance of our implementation when using different Block-Krylov solver techniques.

**Author:** YAMAMOTO, Shuhei (The Cyprus Institute)

**Co-authors:** FINKENRATH, Jacob (The Cyprus Institute); Dr BACCHIO, Simone (The Cyprus Institute)

**Presenter:** YAMAMOTO, Shuhei (The Cyprus Institute)

**Session Classification:** Algorithms (including Machine Learning, Quantum Computing, Tensor Networks)

**Track Classification:** Algorithms (including Machine Learning, Quantum Computing, Tensor Networks)