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Multigrid Preconditioning for the Overlap Operator

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The overlap lattice discretization of the Dirac operator preserves the important physical property of chiral symmetry, at the expense of requiring much more effort when solving systems with this operator. We present a preconditioning technique based on another lattice discretization, the Wilson-Dirac operator. Recently, close to normal operators have gained popularity in numerical simulations. Therefore, we give a mathematical analysis which shows that our preconditioner is effective in an idealized setting where operators are assumed to be normal. This is then confirmed by numerical experiments which are performed for large lattice configurations coming from state-of-the-art physical simulations, implemented on a parallel cluster computer with up to 8,192 cores.

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