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A Time Parallel Implementation of the Time Decomposition Strategy for the Dirac equation HYUN LIM, South Dakota State Univ, ARTHUR KURLEJ, University of Massachusetts, Amhrest, JUNG-HAN KIMN, South Dakota State Univ — For certain formulations of partial differential equations, proper time-parallel pre conditioners can be successfully applied in space-time finite element simulations. Such an approach may enable the extraction of more parallelism to better utilize high performance computing resources. In this work, we examine the behavior of the gauge free, low-mass regime Dirac equation using space-time finite elements. The purpose of this research is to present a stable parallel implementation algorithm of the physical system. We discretize space and time together for the entire domain using a finite element space which does not separate time and space basis functions. We also explore the effectiveness of the time decomposition preconditioner, additive Schwarz preconditioner with KSP (Krylov Subspace Methods) solvers for this problem. We show that proper time parallel implementation allows for physically intuitive boundary conditions, improvement of numerical efficiency, and reduces the overall error of the computed solution

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