Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Application of Equation-Free Projective Integration to Gyrokinetic Turbulence Simulations in XGC BENJAMIN STURDEVANT, ROBERT HAGER, Princeton Plasma Physics Laboratory, LEE RICKETSON, PAUL TRANQUILLI, Lawrence Livermore National Laboratory, CHOONG-SEOCK CHANG, Princeton Plasma Physics Laboratory, JEFFERY HITTINGER, Lawrence Livermore National Laboratory, SCOTT PARKER, University of Colorado at Boulder
— An improved multi-scale time integration method based on equation-free projective integration [1] has been recently developed for accelerating kinetic simulations [2]. Previously, the method was applied to the 4D gyrokinetic particle-in-cell code XGCa and was shown to accurately reproduce neoclassical ion heat transport due to microscopic guiding-center orbital dynamics under Coulomb collisions, while achieving a computational speed up of over 4x compared to brute force time stepping. In this work, we present our efforts to extend the method to the 5D gyrokinetic turbulence code XGC-1 to study the combined effects of turbulence, neoclassical physics, and heat sources on the transport timescale. In addition, algorithmic aspects of the method will be explored using simpler kinetic test problems in 1D-1V. We will present comparisons with other algorithms for addressing long-timescale integration including parallel-in-time. [1] I.G. Kevrekidis, C.W. Gear, J. Hyman, P. Kevrekidis, O. Runborg, and C. Theodoropoulos, Comm. Math. Sci. 1 (4) (2003) 715-762. [2] B. Sturdevant, S. E. Parker, C. S. Chang, and R. Hager, Physics of Plasmas 27, 032505, 2020.

Benjamin Sturdevant
Princeton Plasma Physics Laboratory

Date submitted: 02 Jul 2020 Electronic form version 1.4