Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Enabling Fusion Codes for Upcoming Exascale Platforms ALICE KONIGES, XUEFEI YUAN, WANGYI LIU, Lawrence Berkeley National Laboratory, PRAVEEN NARAYANAN, Nvidia, ROBERT PREISSL, IBM, STEPHANE ETHIER, WEIXANG WANG, STEPHEN JARDIN, Princeton Plasma Physics Laboratory, JEFF CANDY, General Atomics — Emerging computational systems including multicore homogenous nodes as well as accelerated heterogeneous nodes provide new and important platforms for moving plasma modeling codes to the next level of predictive performance. We discuss the effects of these new architectures on plasma physics applications using examples from MHD, plasma turbulence, gyrokinetics, and radiation hydrodynamics. First, we profile the existing codes on current machines, to determine both scalability and bottlenecks [1]. Then, we determine how best to use "application proxies," for fusion, that provide a vehicle for computational scientists to modify and test new programming models in realistic fusion code frameworks. We describe how well these application proxies mimic the performance of full fusion codes, and give examples of the use of advanced programming models to improve their performance.

[1] Performance Characterization and Implications for Magnetic Fusion Co-design Applications, P. Narayanan, et al. Proc. CUG 2011

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Date submitted: 19 Jul 2012 Electronic form version 1.4