

## Publications Produced by the GPSC

### 2004 – Present

#### 2004:

- 1.) Bhat, V., S. Klasky, S. Atchley, M. Beck, D. McCune, and M. Parashar, “High Performance Threaded Data Streaming for Large Scale Simulations”, Proceedings of 5th IEEE/ACM International Workshop on Grid Computing, Grid 2004 Proceedings Nov. 2004 p.243 (2004).
- 2.) Chen, L., R. White, and F. Zonca, “Zonal-Flow Dynamics and Size Scaling of Anomalous Transport”, Phys. Rev. Lett., **92**, 07004 (2004).
- 3.) Ethier, S. and Z. Lin, “Porting the 3D gyrokinetic particle-in-cell code GTC to the NEC SX6 vector architecture: perspectives and challenges”, Comp. Phys. Comm. **164**, 456 (2004).
- 4.) Hahm, T.S., Z. Lin, P.H. Diamond, G. Rewoldt, W.X. Wang, S. Ethier, O. Gurcan, W.W. Lee, and W.M. Tang, “Gyrokinetic Studies of Turbulence in Steep Gradient Region: Role of Turbulence Spreading and ExB Shear”, Proceedings of the 20th International Atomic Energy Agency's (IAEA) Fusion Energy Conference 2004 (CN-116) held in Vilamoura, Portugal, November 1-6, 2004, paper TH/1-4.
- 5.) Keahey, K., M.E. Papka, Q. Peng, D. Schissel, G. Abla, T. Araki, J.R. Burruss, E. Feibush, S. Klasky, P. Lane, T. Leggett, D. McCune, and L. Randerson, “Grids for Experimental Science: The Virtual Control Room”, Proceedings of Second International Workshop on Challenges of Large Applications in Distributed Environments, June 2004, p. 4 (2004).
- 6.) Lin, Z. and T. S. Hahm, “Turbulence Spreading and Transport Scaling in Global Gyrokinetic Particle Simulation”, Phys. Plasmas **11**, 1099 (2004).
- 7.) Lin, Z., L. Chen, Y. Nishimura, H. Qu, T.S. Hahm, J.L.V. Lewandowski, G. Rewoldt, W.X. Wang, P.H. Diamond, C. Holland, F. Zonca, and Y. Li, “Electron Thermal Transport in Tokamaks: ETG or TEM Turbulence?”, presented at the 20th International Atomic Energy Agency's (IAEA) Fusion Energy Conference 2004 (CN-116) held in Vilamoura, Portugal, November 1-6, 2004, paper TH/8-4.
- 8.) Lin, Z., L. Chen, and F. Zonca, “Nonlinear Toroidal Coupling: a New paradigm for Plasma Turbulence”, in Proceedings of Joint Varenna-Lausanne International Workshop on Theory of Fusion Plasmas, Varenna, Italy (2004).
- 9.) Oliner, L., A. Canning, J. Carter, J. Shalf, and S. Ethier, “Scientific Computations on Modern Parallel Vector Systems”, in Proceedings SuperComputing2004, Pittsburgh, PA, (Nominated: Best Paper Award) (2004).
- 10.) Parker, S., Y. Chen and W. Wan, “Electromagnetic gyrokinetic simulations”, Phys. Plasmas **11**, 2494 (2004).
- 11.) Schissel, D.P., J.R. Burruss, A. Finkelstein, S.M. Flanagan, I.T. Foster, T.W. Fredian, M.J. Greenwald, C.R. Johnson, K. Keahey, S.A. Klasky, K. Li, D.C. McCune, M. Papka, Q. Peng, L. Randerson, A. Sanderson, J. Stillerman, R. Stevens, M.R. Thompson, and G. Wallace, “Building the US national fusion grid: results from the national fusion collaborative project”, Fusion Engineering and Design **71**, 245 (2004).

12.) Vadlamani, S., S. Parker, Y. Chen and C. Kim, "The particle-continuum method: an algorithmic unification of particle-in-cell and continuum methods", *Comp. Phys. Comm.*, **164** 209 (2004).

13.) Wang, W.X., W.M. Tang, F.L. Hinton, L.E. Zakharov, R.B. White, and J. Manickam, "Global delta-f Particle Simulation of Neoclassical Transport and Ambipolar Electric Field in General Geometry", *Comp. Phys. Commun.* **164**, 178 (2004).

## **2005:**

14.) Adams, M.F., Y. Nishimura and Van Emden Henson, "Unstructured finite element solvers in gyrokinetic turbulence simulations of burning plasmas", *J. Phys.: Conf. Series* **16**, 410 (2005).

15.) Chen, L., F. Zonca, and Z. Lin, "Nonlinear Toroidal Mode coupling: A New Paradigm for Drift Wave Turbulence in Toroidal Plasmas", *Plasma Phys. Contr. Fusion* **47**, B71 (2005).

16.) Crawford, D., K.-L. Ma, J. Huang, S. Klasky, and S. Ethier, "Visualizing Gyrokinetic Simulations", *Proceedings of Visualization 2004*, 2005 p. 59 (2005).

17.) Ethier, S., W.M. Tang, and Z. Lin, "Gyrokinetic particle-in-cell simulations of plasma micro-turbulence on advanced computing platforms", *J. Phys.: Conf. Series* **16**, 1 (2005).

18.) Hahn T.S., P.H. Diamond, Z. Lin, G. Rewoldt, O. Gurcan, and S. Ethier, "On the dynamics of edge-core coupling", *Phys. Plasmas* **12**, 090903 (2005).

19.) Klasky, S., M. Beck, V. Bhat, E. Feibush, B. Ludaescher, M. Parashar, A. Shoshani, D. Silver, and M. Vouk, "Data Management on the Fusion Computational Pipeline", *J. Phys.: Conference Series* **16**, 510 (2005).

20.) Lewandowski, J.L.V., "Low-Noise Collision Operators for Particle-In-Cell Simulations", *Phys. Plasmas* **12**, 052322 (2005)

21.) Lin, Z., L. Chen, and F. Zonca, "Role of Nonlinear Toroidal Coupling in Electron Temperature Gradient Turbulence", *Phys. Plasmas* **12**, 056125 (2005).

22.) Lin, Z., G. Rewoldt, S. Ethier, T.S. Hahn, W.W. Lee, J.L.V. Lewandowski, Y. Nishimura, and W.X. Wang, "Particle-in-cell simulations of electron transport from plasma turbulence: recent progress in gyrokinetic particle simulations of turbulent plasmas", in *Proceedings of the SciDAC 2005 Conference*, June 26-30, 2005, San Francisco, *J. Phys.: Conference Series* **16**, 16 (2005).

23.) Liu, H., V. Bhat, M. Parashar, and S. Klasky, "An Autonomic Service Architecture for Self-Managing Grid Applications", *Proceedings of the 6th IEEE/ACM International Workshop on Grid Computing*, Grid 2005, Nov. 2005, p. 132 (2005).

24.) Olikier, L., J. Carter, M. Wehner, A. Canning, S. Ethier, A. Mirin, G. Bala, D. Parks, P. Worley, S. Kitawaki, and Y. Tsuda, "Leading Computational Methods on Scalar and Vector HEC Platforms", in *Proceedings SuperComputing2005*, Seattle, WA (2005).

25.) Olikar, L., A. Canning, J. Carter, J. Shalf, D. Skinner, S. Ethier, R. Biswas, J. Djomehri, and R. Van der Wijngaart, "Performance evaluation of the SX-6 vector architecture for scientific computations", *Concurrency and Computation: Practice and Experience* **17**, 69 (2005).

26.) Sugiyama, L.E., W. Park, H.R. Strauss, G. Fu, J. Breslau, J. Chen, and S. Klasky, "Plasmas beyond MHD: two-fluids and symmetry breaking", *J. Phys.: Conference Series* **16**, 54 (2005).

27.) Wan, W., Y. Chen and S. Parker, "Gyrokinetic delta-f simulation of the collisionless and semicollisional tearing mode instability", *Phys. Plasmas* **12** 012311 (2005).

28.) Wang, W.X., Z. Lin, W.M. Tang, W.W. Lee, S. Ethier, J.L.V. Lewandowski, G. Rewoldt, T.S. Hahm, and J. Manickam, "Global gyrokinetic particle simulation of turbulence and transport in realistic tokamak geometry", in *Proceedings of the SciDAC 2005 Conference*, June 26-30, 2005, San Francisco, J. Phys.: Conference Series **16**, 59 (2005).

## **2006:**

29.) Bhat, V., M. Parashar, S. Klasky, M. Khandekar, and N. Kandasamy, "A Self-Managing Wide-Area Data Streaming Service using Model-based Online Control", *Proceedings of Grid 2006*, Sept.2006, p. 176 (2006).

30.) Candy, J., R. Waltz, S. Parker, and Y. Chen, "Relevance of the parallel nonlinearity in gyrokinetic simulations of tokamak plasmas", *Phys. Plasmas* **13** 074501 (2006).

31.) Chen, Y., S. Parker, and J. Lang, "Arbitrary plasma shape and trapped electron modes in the GEM gyrokinetic electromagnetic turbulence simulation code", *J. Phys.: Conference Series* **46** 92 (2006).

32.) Klasky, S., B., Ludaescher, and M. Parashar, "The Center for Plasma Edge Simulation Workflow Requirements", *Proceedings of 22nd International Conference on Data Engineering Workshops (ICDEW'06)*, p. 73 (2006).

33.) Ku, S., C.-S. Chang, M. Adams, J. Cummings, F. Hinton, D. Keyes, S. Klasky, W. Lee, Z. Lin, S. Parker and the CPES team, "Gyrokinetic particle simulation of neoclassical transport in the pedestal/scrape-off region of a tokamak plasma", *J. Phys.: Conf. Ser.* **46**, 87 (2006).

34.) Lee, W.W., S. Ethier, T. G. Jenkins, W. X. Wang, J. L. V. Lewandowski, G. Rewoldt, W. M. Tang, S. E. Parker, Y. Chen, and Z. Lin, "Long Time Simulations of Microturbulence in Fusion Plasmas", Presented at Fusion Energy 2006, Chengdu, China, Paper TH/2-6Rb, *Proceedings of the 21st IAEA Conference*, Chengdu (2006).

35.) Lee, W.W., S. Ethier, W. X. Wang, W. M. Tang and S. Klasky, "Gyrokinetic particle simulation of fusion plasmas: path to petascale computing", Presented at SciDAC 2006, Denver CO., *J. of Phys.: Conference Series* **46**, 73 (2006).

36.) Lewandowski, J.L.V., G. Rewoldt, S. Ethier, W. W. Lee and Z. Lin, "Global Particle-In-Cell Simulations of Microturbulence with Kinetic Electrons", *Phys. Plasmas* **13**, 072306 (2006).

37.) Li, Jiquan, K. Uzawa, Z. Lin, Y. Kishimoto, N. Miyato, T. Matsumoto, and J.Q. Dong, "Simulations on the Nonlinear Mode Coupling in Multiple-scale Drift-type Turbulence with Coherent Flow Structures", in *Proceedings of the 21<sup>th</sup> International Conference on Plasma Physics and Controlled*

Nuclear Fusion Research (Chengdu, China, 2006) (International Atomic Energy Agency, Vienna, Austria, 2006) Paper IAEA-CN-138/TH/2-3.

38.) Lin, Z., L. Chen, I. Holod, Y. Nishimura, H. Qu, S. Ethier, G. Rewoldt, W. X. Wang, Y. Chen, J. Kohut, S. Parker, and S. Klasky, “Electron Transport Driven by Short Wavelength Trapped Electron Mode Turbulence”, in Proceedings of the 21<sup>th</sup> International Conference on Plasma Physics and Controlled Nuclear Fusion Research (Chengdu, China, 2006) (International Atomic Energy Agency, Vienna, Austria, 2006) Paper IAEA-CN-138/TH/P2-8.

39.) Nishimura Y. and Z. Lin, “A finite element mesh in a tokamak edge geometry”, *Contrib. Plasma Phys.* **46**, 51 (2006).

40.) Nishimura, Y., Z. Lin, J.L.V. Lewandowski, and S. Ethier, “A finite element Poisson solver for gyrokinetic particle simulations in a global field aligned mesh”, *J. Comp. Phys.* **214**, 657 (2006).

41.) Parker, S., J. Kohut, Y. Chen, Z. Lin, F. Hinton, W. Lee, “Fine-scale zonal flow suppression of electron temperature gradient turbulence”, *AIP Conf. Proc.* **871**, 193 (2006).

42.) Wang, W.X., T.S. Hahm, G. Rewoldt, J. Manickam and W.M. Tang, “Gyrokinetic studies of Nonlocal Properties of Turbulence-driven and Neoclassical Transport”, in Proceedings of the 21<sup>th</sup> International Conference on Plasma Physics and Controlled Nuclear Fusion Research (Chengdu, China, 2006) (International Atomic Energy Agency, Vienna, Austria, 2006) Paper IAEA-CN/TH/2-6Ra (2006).

43.) Wang, W.X., G. Rewoldt, W.M. Tang, F.L. Hinton, J. Manickam, L.E. Zakharov, R.B. White, and S. Kaye, “Nonlocal neoclassical transport in tokamak and spherical torus experiments”, *Phys. Plasmas* **13**, 082501 (2006).

44.) Wang, W.X., Z. Lin, W.M. Tang, W.W. Lee, S. Ethier, J.L.V. Lewandowski, G. Rewoldt, T.S. Hahm, and J. Manickam, “Gyro-kinetic simulation of global turbulent transport properties in tokamak experiments”, *Phys. Plasmas* **13**, 092505 (2006).

## **2007:**

45.) Adams, M.F., and Y. Nishimura, “Parallel Algebraic Multigrid Methods in Gyrokinetic Turbulence Simulations”, *Commun. Comput. Phys.* **2**, 827 (2007).

46.) Adams, M.F., S. Ethier, N. Wichmann and W. W. Lee, “Performance of particle in cell methods on highly concurrent computational architectures”, *J. Phys.* *in press* (2007).

47.) Bhat, V., M. Parashar, and S. Klasky, “Experiments with In-transit processing for data intensive Gridworkflows”, submitted to 7th IEEE/ACM International Workshop on Grid Computing, Grid 2007 (2007).

48.) Brizard, A.J., and T.S. Hahm, “Foundations of Nonlinear Gyrokinetic Theory”, *Rev. Mod. Phys.* **79**, 421 (2007).

49.) Chen, Y., and S. Parker, “Electromagnetic gyrokinetic delta-f particle-in-cell turbulence simulation with realistic equilibrium profiles and geometry”, *J. Comp. Phys.* **220** 839 (2007).

- 50.) Chen, Y., and S. Parker, "Coarse-graining phase space in delta-f particle-in-cell simulations", submitted to Phys. Plasmas (2007).
- 51.) Ethier, S., W.M. Tang, R. Walkup, and L. Oliker, "Large Scale Gyrokinetic Particle Simulation of Microturbulence in Magnetically Confined Plasmas", submitted to IBM Journal of Research and Development (2007).
- 52.) Gurcan, O.D., P.H. Diamond, T.S. Hahm, and R. Singh, "Intrinsic Rotation and Electric Field Shear", Phys. Plasmas **14**, 042306 (2007).
- 53.) Hahm, T.S., P.H. Diamond, Z. Lin, G. Rewoldt, O. Gurcan, and S. Ethier, "On the Dynamics of Edge-Core Coupling", Phys. Plasmas **12**, 090903 (2007).
- 54.) Hahm, T.S., P.H. Diamond, O.D. Gurcan, and G. Rewoldt, "Nonlinear Gyrokinetic Theory of Toroidal Momentum Pinch", Phys. Plasmas, *in press* (2007).
- 55.) Holod, I., and Z. Lin, "Statistical analysis of fluctuations and noise driven transport in particle-in-cell simulations of plasma turbulence", Phys. Plasmas **14**, 032306 (2007).
- 56.) Jenkins, Thomas G., and W. W. Lee, "Fluctuations and Discrete Particle Noise in Gyrokinetic Simulation of Drift Waves", Phys. Plasmas **14**, 032307 (2007)
- 57.) Lang, J., Y. Chen and S. Parker, "Gyrokinetic delta-f particle simulation of trapped electron mode driven turbulence", submitted to Phys. Plasmas (2007).
- 58.) Liao, W., A. Choudhary, S. Klasky, J. Chen, and R. Sankaran, "Using MPI File Caching to Improve Parallel Write Performance for large-scale Scientific Applications", submitted to Supercomputing 2007 (2007).
- 59.) Nishimura Y., Z. Lin, and W.X. Wang, "Electromagnetic global gyrokinetic simulation of shear Alfvén wave dynamics in tokamak plasmas", Phys. Plasmas **14**, 042503 (2007).
- 60.) Oliker, L., A. Canning, J. Carter, C. Iancu, M. Lijewski, S. Kamil, J. Shalf, H. Shan, E. Strohmaier, S. Ethier, and T. Goodale, "Scientific Application Performance on Candidate Petascale Platforms", Proceedings of IEEE International Parallel and Distributed Processing Symposium, 2007, Long Beach, CA (2007) (Best Paper Award).
- 61.) Podhorszki, N., B. Ludaescher, and S. Klasky, "Workflow automation for processing simulation data in Kepler", Proceedings of 2nd workshop on workflows in support of large-scale science, in conjunction with HPDC 2007, Monterey Bay California, June 25 2007; accepted (2007).
- 62.) Rewoldt, G., Z. Lin, and Y. Idomura, "Linear Comparison of Gyrokinetic Codes with Trapped Electrons", Report PPPL-4195, submitted to Comp. Phys. Commun. (2007).
- 63.) Startsev, E.A., W. W. Lee and W. X. Wang, "Simulation of Finite-beta Effects in Gyrokinetic Plasmas", Sherwood Theory Meeting, manuscript in preparation (2007).
- 64.) Vouk, M., S. Klasky, et al., "Automation of Network-Based Scientific Workflows", submitted to IFIP Working Conference (2007).

65.) Wang, W.X., T.S. Hahm, W. Lee, G. Rewoldt, J. Manickam, and W.M. Tang, “Nonlocal Properties of Gyrokinetic Turbulence and Role of ExB shear”, *Phys. Plasmas* *in press* (2007).

66.) Wang, W.X., M. Bell, S. Ethier, T.S. Hahm, S.M. Kaye, W.W. Lee, J. Manickam, G. Rewoldt, and W.M. Tang, “Gyrokinetic Simulation Studies of Plasma Transport in NSTX Experiments”, TTF'07, Sherwood'07, EPS'07 (paper in preparation).

67.) Wolf, M., H. Abbasi, A. Gavrilovska, and S. Klasky “Structured Steams: Data Services for Petascale Science Environments”, submitted to Supercomputing 2007 (2007).