Jonathan Pietarila Graham

Contact Information

Computational Fluid Dynamics (T-3) & Center for Non-linear Studies
Los Alamos National Laboratory, MS-B258 — *Work:* +1-(505) 665-1830
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Education

University of Colorado, *Applied Mathematics Department*, Boulder, CO USA

Ph.D. in Applied Mathematics, 11 August 2007

- Dissertation: *Regularizations as subgrid models for turbulent flows*, NCAR CT-177
- Advisor: Annick Pouquet

Masters of Science in Applied Mathematics, August 2005

- Thesis: *Turbulent intermittency in the Lagrangian-averaged alpha model*, NCAR CT-176
- Advisor: Annick Pouquet

Oklahoma State University, *Department of Physics*, Stillwater, OK USA

Bachelor of Science in Physics with Honors, December 1993

- Undergraduate Honors Thesis: *Controlling Chaos*
- Advisor: Donna Bandy

Professional Experience

Computational Fluid Dynamics (T-3) & Center for Non-linear Studies, Los Alamos National Laboratory, Los Alamos, NM USA

CNLS Postdoctoral Research Associate, **2011 -**

- Large eddy simulations for 2D flows
- Compressible energy transfer analysis for supersonic flow

Department of Applied Mathematics & Statistics, The Johns Hopkins University, Baltimore, MD USA

Postdoctoral Fellow, **2010**

- 3D flow visualizations of extreme events in the JHU Turbulence Database Cluster (TDC)

Solar MHD Group, Sun and Heliosphere Department, Max Planck Institute for Solar System Research, Katlenburg-Lindau, Germany

Postdoctoral Fellow, **2007 - 2010**

- Deriving spectral energy transfer functions for compressible magnetohydrodynamics (MHD)
- Parallelized coding for computational fluid dynamics
- High performance computing on thousands of processors
- Testing solar simulations for small-scale dynamo action linked to intranetwork magnetic activity

Turbulence Numerics Team, Institute for Mathematics Applied to Geosciences, National Center for Atmospheric Research, Boulder, CO USA

Graduate Research Assistant, **2004 - 2007**

- Validating subgrid models for turbulent hydrodynamic and MHD flows
- Deriving Kármán-Howarth theorems for the models
- Analyzing high-order structure functions and visualizing flows

High Altitude Observatory, National Center for Atmospheric Research, Boulder, CO USA

Associate Scientist, **1999 - 2004**

- Inferring solar vector magnetic field from filtergraph polarimetric data
- Supervising student assistant

Research Applications Program, National Center for Atmospheric Research, Boulder

Systems Administrator **1996 - 1999**

Jonathan Pietarila Graham

Research Interests

High-order numerics and subgrid modeling (regularizations, LES) and their application–to extend the range of physical parameters probed by large, parallel simulations (especially for flows with strong, impulsive events) as well as new models and smoothness properties (computability). HPC and CFD for compressible, incompressible, hydrodynamic and magnetohydrodynamic turbulence.

Memberships

Society for Industrial and Applied Mathematics (SIAM)
American Mathematical Society (AMS)
American Physical Society (APS)
American Geophysical Union (AGU)

Refereed Publications

1. **Jonathan Pietarila Graham**, Eric G. Blackman, Pablo D. Mininni, and Annick Pouquet, *Minute Kinetic Helicity Can Drive Large Scale Dynamos*, Phys. Rev. Lett. *submitted* 2011; arXiv:1108.3039.
2. **J. Pietarila Graham**, P. D. Mininni, and A. Pouquet, *High Reynolds number magnetohydrodynamic turbulence using a Lagrangian model*, Phys. Rev. E **84**, 016314, 2011; arXiv:1102.5581.
3. R. Moll, **J. Pietarila Graham**, J. Pratt, R. H. Cameron, W.-C. Müller, and M. Schüssler, *Universality of the Small-Scale Dynamo Mechanism*, ApJ **736**, 36, 2011; arXiv:1105.0546.
4. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *The effect of subfilter-scale physics on regularization models*, J. Sci. Comp. **49**, 21-34, 2011; arXiv:1003.0335.
5. **Jonathan Pietarila Graham**, Robert Cameron, and Manfred Schüssler, *Turbulent small-scale dynamo action in solar surface simulations*, ApJ **714**, 1606-1616, 2010; arXiv:1002.2750.
6. **Jonathan Pietarila Graham**, Sanja Danilovic, and Manfred Schüssler, *Turbulent magnetic fields in the quiet Sun: implications of* Hinode *observations and small-scale dynamo simulations*, ApJ **693**, 1728-1735, 2009; arXiv:0812.2125.
7. **Jonathan Pietarila Graham**, Pablo D. Mininni, and Annick Pouquet, *Lagrangian-averaged model for magnetohydrodynamic turbulence and the absence of bottlenecks*, Phys. Rev. E **80**, 016313, 2009; arXiv:0806.2054.
8. **J. Pietarila Graham**, D. D. Holm, P. Mininni, and A. Pouquet, *Three regularization models of the Navier-Stokes equations*, Phys. Fluids **20**, 035107, 2008; arXiv:0709.0208.
9. **Jonathan Pietarila Graham**, Darryl D. Holm, Pablo D. Mininni, and Annick Pouquet, *Highly turbulent solutions of the Lagrangian-averaged Navier-Stokes α model and their large-eddy-simulation potential*, Phys. Rev. E **76**, 056310, 2007; arXiv:0704.1928.
10. **J. Pietarila Graham**, D. D. Holm, P. Mininni, and A. Pouquet, *Inertial range scaling, Kármán-Howarth theorem, and intermittency for forced and decaying Lagrangian Averaged magnetohydrodynamic equations in two dimensions*, Phys. Fluids **18**, 045106, 2006; arXiv:physics/0508173.
11. Norton, A. A., **J. Pietarila Graham**, R. K. Ulrich, J. Schou, S. Tomczyk, Y. Liu, B. W. Lites, A. López Ariste, R. I. Bush, H. Socas-Navarro, and P. H. Scherrer, *Spectral Line Selection for* HMI: *A Comparison of FeI 6173 Å and NiI 6768 Å,* Solar Physics **239**, 69-91, 2006; arXiv:astro-ph/0608124.
12. **Jonathan Pietarila Graham**, Pablo D. Mininni, and Annick Pouquet, *Cancellation exponent and multifractal structure in two-dimensional magnetohydrodynamics: direct numerical simulations and Lagrangian averaged modeling*, Phys. Rev. E **72**, 045301(R), 2005; arXiv:physics/0506088.

13. **J. D. Graham**, A. López Ariste, H. Socas-Navarro, and S. Tomczyk, *Inference of* Solar Magnetic Field *Parameters from Data with Limited Wavelength Sampling*, Solar Physics **208**, p. 211-232, 2002.

14. Protsenko, I. E., A. N. Oraevsky, **J. D. Graham**, and D. K. Bandy, *Multistabilities in a Thin Layer Semiconductor Laser with an Inclined External Cavity*, Laser Physics **6**, p. 1-8, 1996.

15. Bandy, D. K., **J. D. Graham**, D. J. Jones, A. N. Oraevsky, and T. Sarkisyan, *Dynamics of a Monovelocity Atomic Beam Maser Framed in a Semiclassical Mod*el, Phys. Rev. A **50**, p. 685-697, 1994.

Conference Proceedings

1. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *The effect of subfilter-scale physics on regularization models*, Proceedings of the Quality and Reliability of Large-Eddy Simulations II 2009 Workshop, Springer;
2. **Jonathan Pietarila Graham**, Sanja Danilovic, and Manfred Schüssler, *The small-scale solar surface dynamo*, Proceedings of The Second Hinode Science Meeting: Beyond Discovery-Toward Understanding, ed. B. Lites, M. Cheung, T. Magara, J. Mariska, and K. Reeves, ASP Conf. Ser. Vol. 415, p. 43, 2009; arXiv:1003.0347.
3. Pouquet, A., Baerenzung, J., **Pietarila Graham, J.**, Mininni, P., Politano, H., and Ponty, Y., *Modeling of anisotropic turbulent flows with either magnetic fields or imposed rotation*, Proceedings of the TI2009 Conference in "Notes on Numerical Fluid Mechanics and Multidisciplinary Design," Springer; arXiv:0904.4860.
4. Norton, A. A., **J. D. Pietarila Graham**, R. K. Ulrich, J. Schou, S. Tomczyk, Y. Liu, B. W. Lites, A. López Ariste, R. I. Bush, H. Socas-Navarro, and P. H. Scherrer, *Spectral Line Selection for* HMI, Proceedings of Solar Polarization 4, ed. R. Casini and B. W. Lites, ASP Conf. Ser. Vol. 358, p. 193, 2006.
5. Rees, D., Y. Guo, A. López Ariste, and **J. Graham**, *Real Time Stokes Inversion Using Multiple Support Vector Regression*, Proceedings of the Eighth International Conference on Knowledge-Based Intelligent Information & Engineering Systems, Wellington, New Zealand, 2004.
6. **J. D. Graham**, A. A. Norton, A. López Ariste, B. Lites, H. Socas-Navarro, and S. Tomczyk, *The Helioseismic and Magnetic Imager* (HMI) *on SDO: Full Vector Magnetography with a Filtergraph Polarimeter*, Proceedings of the Third International Workshop on Solar Polarization, ed. J. Trujillo-Bueno and J. Sanchez-Almeida, ASP Conf. Ser. Vol. 307, p.131, 2003.

Presentations and Posters

1. **Jonathan Pietarila Graham**, Rainer Moll, Jane Pratt, Robert Cameron, Wolf-Christian Müller, and Manfred Schüssler, *Universality of the Small-Scale Dynamo Mechanism* (poster), Solar Physics Division Meeting, Las Cruces, USA, June 2011.
2. **Jonathan Pietarila Graham**, Rainer Moll, Robert Cameron, and Manfred Schüssler, *Small-scale dynamo in solar surface simulations*, American Geophysical Union, Fall Meeting, San Francisco, USA, December 2010.
3. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Lagrangian-averaged Large Eddy Simulations for fluid/magnetofluid turbulence*, Research Unit 1048: Instabilities, Turbulence and Transport in Cosmic Magnetic Fields Seminar, Bochum, Germany, June 2010.
4. **Jonathan Pietarila Graham**, Robert Cameron, Sanja Danilovic, and Manfred Schüssler, *Turbulent Small-scale Dynamo (SSD) Action in Solar Surface Simulations*, Joint Geophysical Turbulence Program and High Altitude Observatory Seminar, Boulder, USA, February 2010.

5. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *The effect of subfilter-scale properties on regularization models*, Quality and Reliability of Large Eddy Simulations II, Pisa, Italy, September 2009.
6. **Jonathan Pietarila Graham**, Robert Cameron, and Manfred Schüssler, *Transfer analysis of a local surface dynamo*, German physical society (DPG), Extraterrestrial Physics and Plasma Physics Spring Conference, Greifswald, Germany, April 2009.
7. **Jonathan Pietarila Graham**, Sanja Danilovic, and Manfred Schüssler, *How well do Zeeman measurements reflect the turbulent solar magnetic field?* (poster), 12th European Solar Physics Meeting, Freiburg, Germany, September 2008.
8. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *MHD turbulence: What is it? Why do we care? What can we do about it?*, Oberseminar Extraterrestrische Physik, Institut für Geophysik und Meteorologie, Universität zu Köln, Germany, April 2008.
9. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Lagrangian-averaged modeling for hydrodynamics and MHD*, 10. MHD-Tage, Max-Planck-Institut für Plasmaphysik, Garching, Germany, November 2007.
10. **Jonathan Pietarila Graham**, *Regularization subgrid modeling for turbulence*, Geophysical Turbulence Program Seminar, National Center for Atmospheric Research, Boulder, USA, August 2007.
11. **J. Pietarila Graham**, *Regularizations as subgrid models for turbulent flows*, Ph.D. Thesis Defense, University of Colorado, Boulder, USA, July 2007.
12. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Three regularizations as turbulent subgrid models*, American Physical Society, APS March Meeting, abstract #B30.004, Denver, USA, March 2007.
13. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Regularizations as subgrid models for turbulent flows*, Dynamics Seminar, Dept. of Applied Mathematics, University of Colorado at Boulder, USA, February 2007.
14. **Jonathan Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Three regularization models as large-eddy simulations*, American Physical Society, 59th Annual DFD Meeting, abstract #GO.3, Tampa Bay, USA, November 2006.
15. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *MHD Turbulence and the α-model*, Seminar, Nordita, Stockholm, Sweden, October 2006.
16. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *MHD Turbulence and the α-model*, Seminar, Instituto de Astrofísica de Canarias, Tenerife, Spain, October 2006.
17. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Intermittency in MHD turbulence: DNS and Lagrangian averaged modeling*, Modeling magnetohydrodynamic turbulence; application to planetary and stellar dynamos, Geophysical Turbulence Program Workshop, National Center for Atmospheric Research, Boulder, USA, June 2006.
18. **Jonathan Pietarila Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Intermittency in turbulence: DNS and Lagrangian averaged modeling*, Center for Nonlinear Analysis Summer School, Carnegie Mellon University, Pittsburgh, USA, May 2006.
19. **Jonathan Graham**, Darryl Holm, Pablo Mininni, and Annick Pouquet, *Intermittency in magnetohydrodynamic turbulence: DNS and Lagrangian averaged modeling*, American Physical Society, 47th Annual DPP Meeting, abstract #RO2.004, Denver, USA, October 2005.
20. **J. Pietarila Graham**, *Turbulent Intermittency in the Lagrangian-Averaged Alpha Model*, Masters Thesis Defense, University of Colorado, Boulder, USA, May 2005.

21. Liu, Y., Norton, A. A., Tomczyk, S., Bush, R. I., **Graham, J. D.**, Lites, B. W., López Ariste, A., Scherrer, P. H., Schou, J., Socas-Navarro, H., Ulrich, R. K., *The Choice of the Spectral Line for the* HMI/SDO: *from Observational Point of View*, 4th Solar Polarization Workshop, Boulder, USA, September 2005.
22. Norton, A. A., **J. D. Graham**, B. W. Lites, H. Socas-Navarro, and S. Tomczyk, *Vector Magnetometry with* HMI (poster), NASA LWS Science Workshop, Boulder, USA, March 2004.
23. Bush, R., P. Scherrer, J. Schou, Y. Liu, S. Tomczyk, **J. Graham**, and A. Norton, *Vector Magnetic Field Measurement Capability of the* Helioseismic and Magnetic Imager on SDO, American Geophysical Union, abstract #SH52A-0464, Fall Meeting 2002.
24. **J. D. Graham**, *The Helioseismic & Magnetic Imager* (HMI) on SDO: *Proof of Concept & Line Selection*, Third International Workshop on Solar Polarization, Puerto de La Cruz, Spain, October 2002.
25. **J. D. Graham**, B. W. Lites, A. López Ariste, A. Norton, H. Socas-Navarro, and S. Tomczyk, *Inference of* Solar Vector Magnetic Fields *with Filtergraph Instruments* (poster), AAS Meeting 200, #56.11; Bulletin of the AAS, Vol. 34, p.736, Albuquerque, USA, June 2002.
26. **J. D. Graham**, *Inference of* Solar Magnetic Fields *from Data with Limited Wavelength Sampling*, Department of Physics Seminar, Stanford University, Palo Alto, USA, February 2002.

Referee activity

Refereed articles for Journal of Computational Physics, Physics of Fluids, Astrophysical Journal Letters, and Astronomy & Astrophysics. Refereed proposals for the American Chemical Society Petroleum Research Fund and the Philosophical Transactions of the Royal Society A.

Workshops

SOLAIRE PostGraduate School, Computational Methods in Astrophys., Bochum, 3-14 March 2008

Minicourse on Conceptual Aspects of Turbulence: Mean Fields vs. Fluctuations, Wolfgang Pauli Institute, Vienna, 11-15 Feb. 2008

Minicourse on Turbulence: Concepts & Methods, Wolfgang Pauli Institute, Vienna, 8-10 Oct. 2007

Field studies in solar physics

2003 - Advanced Stokes Polarimeter at the Dunn Solar Telescope, Sacramento Peak Solar Observatory, Sunspot, NM. Simultaneous observations of 6768 Ni I line and 6173 Fe I line to determine line selection for HMI.

2001 - Advanced Stokes Polarimeter at the Dunn Solar Telescope, Sacramento Peak Solar Observatory, Sunspot, NM. Observation of spectrapolarimetric data for Ni I line for evaluation of using this line for a filtergraph polarimeter.

Invited talks

1. **Jonathan Pietarila Graham**, Robert Cameron, Sanja Danilovic, and Manfred Schüssler, *Small-scale dynamo action in solar surface simulations*, Self-Organization in Turbulent Plasmas and Fluids, Dresden, Germany, May 2010.
2. **Jonathan Pietarila Graham**, Sanja Danilovic, Manfred Schüssler, and Alexander Vögler, *The solar surface dynamo* (*Keynote*), Second Hinode Science Meeting, Boulder, USA, September 2008.