

Benjamin A. Breech

Office

Goddard Space Flight Center
Mail Stop 673
8800 Greenbelt Road
Greenbelt, MD 20771
Phone: 301.286.7954

Home

16028 English Oaks Ave, Apt F
Bowie, MD 20716

Email: babreech@gmail.com

Web: <http://www.cis.udel.edu/~breech/>

Research Interests

CS: Dynamic Compilation, Program Analysis, Compilers and Security.

Physics: Magnetohydrodynamic Turbulence, Solar Wind, Computational Physics.

Education

Ph.D. Computer and Information Sciences, University of Delaware, Newark, DE.
Fall 2008.

Advisor: Dr. Lori Pollock

Dissertation: *Improving Security Testing and Software Maintenance Through Dynamic Compilers.*

Ph.D. Physics, University of Delaware, Newark, DE. May 2008.

Advisor: Dr. William H. Matthaeus

Dissertation: *Topics in Solar Wind Turbulence.*

M.S. Computer and Information Sciences, University of Delaware. Newark, DE. May 2001.

B.S. Computer Science, Shippensburg University, Shippensburg, PA. May 1998.

B.A. Physics, Shippensburg University, Shippensburg, PA. May 1998.

Honors and Awards

NASA Postdoctoral Program (NPP) Fellow Award, Sept 2008 - present. Won one of approximately 50 awards given annually to fund postdoctoral appointments of one to three years at one of the NASA Space Centers. Currently at Goddard Space Flight Center in Greenbelt, MD, researching turbulence transport in the solar wind.

University of Delaware Dissertation Fellows Award, Fall 2007 - Spring 2008. University wide competition of grad students within 1 year of finishing their dissertations for year-long fellowships.

NASA Delaware Space Grant Fellowship 2005-2007. One of four winners of a fellowship for graduate students among schools in the Delaware Valley (Delaware, south eastern Pennsylvania, and eastern Maryland).

ACM SIGSOFT CAPS Travel Award to present at Software Engineering for Secure Systems and attend International Conference on Software Engineering May 2005.

University of Delaware Graduate Student Travel Award to present at International Conference on Software Maintenance Sept. 2004. University wide competition of grad students for a travel award.

University of Delaware Competitive Fellowship 2003-2004. University wide competition of grad students for year-long fellowships.

Selected as 1 of 15 nationwide participants in the NASA Summer School for High Performance Computational Earth and Space Sciences at NASA Goddard Space Flight Center (2003).

Selected for membership in Kappa Mu Epsilon Mathematics Honor Society. Spring 1996. Shippensburg University. Shippensburg, PA.

Teaching Experience

Instructor: Responsible for developing entire courses; including developing and presenting lectures, creating both programming and written assignments, and supervising a teaching assistant:

CISC220: Data Structures, Summer 2004 (10 weeks long, taken by sophomores).

CISC370: Java, OOP and the WWW (Object Oriented Programming using Java), Summer 2002 (10 weeks long, taken by juniors and seniors).

CISC105: General Computer Science (Programming in C), Summers 2000 and 2001, Winters 2001 and 2002 (5 weeks long, taken by freshman and sophomores).

CISC367: Programming Practices: Rapid Prototyping (fast problem solving using C++ STL), Fall 2006, 2007 (met once a week for 3 hours, open to all undergraduates).

Coach/Mentor of UD ACM Programming Team: Fall 1998 to Spring 2008. Mentor undergraduate students in problem solving and teamwork in time pressured situations. Students participate in local contests, and the ACM Mid-Atlantic Regional Programming Contest held annually in fall.

Research Mentor, Senior undergraduate research: Summer 2004 - Winter 2005. Served as mentor for Mr. Michael Tegtmeier, a University of Delaware undergraduate, currently at the Army Research Lab. Mr. Tegtmeier collaborated on research for online impact analysis algorithms.

Lab Instructor: Responsible for conducting weekly laboratory sessions, grading assignments and exams, and holding weekly office hours.

CISC105: General Computer Science (Programming in C), Fall 1998, Summer 1999 and Summer 2000.

CISC181: Introduction to Computer Science (Programming in C++), Summer 1999.

PHYS207: Fundamentals of Physics I (mechanics), Spring 2000.

Discussion Instructor: Responsible for conducting weekly problem solving sessions, grading assignments and exams, and holding weekly office hours.

PHYS208: Fundamentals of Physics II (electricity and magnetism), Fall 2000 (taken by sophomores).

PHYS207: Fundamentals of Physics I (mechanics), Spring 2001 (taken by freshmen).

Guest Lecturer: CISC 672 (Advanced Compiler Construction). Lectures on scanning and parsing techniques for graduate level compiler course. Spring 2002.

Refereed Publications

Physics

B. Breech, W.H. Matthaeus, S.R. Cranmer, J.C. Kasper, and S. Oughton, **Electron and Proton Heating by Solar Wind Turbulence**, *Journal of Geophysical Research*, (in press), 2009.

S.R. Cranmer, W.H. Matthaeus, B. Breech, and J.C. Kasper, **Empirical Constraints on Proton and Electron Heating in the Fast Solar Wind**, *Astrophysical Journal*, (in press), 2009.

- C. Pei, J.W. Bieber, B. Breech, R.A. Burger, J. Clem and W.H. Matthaeus, **Cosmic Ray Diffusion Tensor Throughout the Heliosphere**, *Journal of Geophysical Research*, (submitted) 2009.
- B. Breech, W.H. Matthaeus, J. Minnie, J.W. Bieber, S. Oughton, C.W. Smith and P.A. Isenberg, **Turbulence Transport Throughout the Heliosphere**, *Journal of Geophysical Research*, 2008.
- W.H. Matthaeus, A. Pouquet, P.D. Mininni, P. Dmitruk and B. Breech, **Rapid Alignment of Velocity and Magnetic Field in Magnetohydrodynamic Turbulence**, *Physical Review Letters*, 2008.
- W.H. Matthaeus, B. Breech, P.Dmitruk, A. Bemporad, G. Poletto, M. Velli and M. Romoli, **Density and Magnetic Field Signatures of Interplanetary 1/f Noise**, *Astrophysical Journal*, 2007.
- B. Breech, W. H. Matthaeus, J. Minnie, S Oughton, S. Parhi, J.W. Bieber and B. Bavassano, **Radial Evolution of Cross Helicity at Low and High Latitudes in the Solar Wind**, *Proceedings of Solar Wind 11, American Institute of Physics*, 2005.
- B. Breech, W.H. Matthaeus, J. Minnie, S. Oughton, S. Parhi, J.W. Bieber, and B. Bavassano, **Radial evolution of cross helicity in high latitude solar wind**, *Geophysical Research Letters*, 2005.
- W.H. Matthaeus, J. Minnie, B. Breech, S. Parhi, J.W. Bieber, and S. Oughton, **Transport of cross helicity and the radial evolution of Alfvénicity in the solar wind**, *Geophysical Research Letters*, 2004.
- B. Breech, L.J. Milano, W. H. Matthaeus, and C. W. Smith, **Probability Distributions of the Induced Electric Field of the Solar Wind**, *Journal Geophysical Research*, April 2003.
- B. Breech, L.J. Milano, W. H. Matthaeus, and C.W. Smith, **Electric Field Statistics in the Solar Wind**, *Proceedings of Solar Wind 10, American Institute of Physics*, 2002.
- L.J. Milano, W. H. Matthaeus, B. Breech, and C.W. Smith, **Distribution of Turbulent Electric Field in Quasnormal Turbulence**, *Physical Review E*, February 2002.

Computer Science

- Ben Breech, Lori Pollock and John Cavazos, **RUGRAT: Runtime Test Case Generation using Dynamic Compilers**, *IEEE International Symposium on Software Reliability Engineering (ISSRE)*, Nov. 2008. (25% acceptance rate)
- Ben Breech, Mike Tegtmeyer and Lori Pollock, **An Attack Simulator for Systematically Testing Program-Based Security Mechanisms**, *IEEE International Symposium on Software Reliability Engineering (ISSRE)*, Nov. 2006. (30% acceptance rate)
- Ben Breech, Mike Tegtmeyer and Lori Pollock, **Integrating Influence Mechanisms into Impact Analysis for Increased Precision**, *IEEE International Conference on Software Maintenance (ICSM)*, Sept. 2006. (30% acceptance rate)
- Ben Breech and Lori Pollock, **A Framework for Testing Security Mechanisms for Program-Based Attacks**, *ACM/IEEE Software Engineering for Secure Systems (SESS), co-located with the International Conference on Software Engineering (ICSE)*, May 2005. (41% acceptance rate)
- Ben Breech, Mike Tegtmeyer, and Lori Pollock, **A Comparison of Online and Dynamic Impact Analysis Algorithms**, *IEEE European Conference on Software Maintenance and Reengineering*, March 2005. (41% acceptance rate)

B. Breech, A. Danalis, Stacey Shindo, and Lori Pollock, **Online Impact Analysis via Dynamic Compilation Technology**, *IEEE International Conference on Software Maintenance (ICSM)*, Sept. 2004. (42% acceptance rate)

Tom Way, Ben Breech, Wei Du, and Lori Pollock, **Demand-Driven Inlining Heuristics in Region-Based Optimization for ILP Architectures**, *IASTED International Conference on Parallel and Distributed Computing and systems (PDCS)*, August 2001.

Tom Way, Ben Breech, Wei Du, Veselin Stoyanov, and Lori Pollock, **Using Path-Spectra-Based Cloning in Region-Based Optimization for Instruction-Level Parallelism**, *ISCA 14th International Conference on Parallel and Distributed Computing Systems, (ISCA PDCS)*, August 2001.

Tom Way, Ben Breech, Lori Pollock, **Region Formation Analysis with Partial Inlining for Scalable Region-Based Compilation**, *IEEE/ACM International Conference on Parallel Architectures and Compilation Techniques (PACT)*, October 2000. (22% acceptance rate)

Oral Presentations

B. Breech, W.H. Matthaeus, S. Cranmer, J.C. Kasper, and S. Oughton, **Heating the Solar Wind Through Turbulence and Electron Heat Conduction Models**, presented at *Fall meeting of the American Geophysics Union*, 2008.

B. Breech, W.H. Matthaeus, S. Cranmer, J.C. Kasper, and S. Oughton, **Modeling the Heating of the Solar Wind: Turbulence and Electron heat Conduction**, presented at *American Physics Society, Division of Plasma Physics Fall Meeting*, 2008.

Ben Breech, Lori Pollock and John Cavazos, **RUGRAT: Runtime Test Case Generation using Dynamic Compilers**, presented at *IEEE International Symposium on Software Reliability Engineering (ISSRE)*, Nov. 2008.

W.H. Matthaeus, A. Pouquet, P. Mininni, P. Dmitruk, and B. Breech, **Rapid Directional alignment of Velocity and Magnetic Fields in Magnetohydrodynamic Turbulence**, presented at *Fall meeting of the American Geophysics Union*, 2007.

Introduction to LaTeX, 50 min. lecture given at *CISC 890: SIG NewGrad, University of Delaware*, Oct. 2007.

Topics in Solar Wind Turbulence & Some Uses of Dynamic Compilers for Software Engineering, presented at *First Annual Delaware Valley NASA Space Grant Symposium*, Nov. 2006.

An Attack Simulator for Systematically Testing Program-Based Security Mechanisms, presented at *International Symposium on Software Reliability Engineering (ISSRE)*, Nov. 2006.

Integrating Influence Mechanisms into Impact Analysis for Increased Precision, presented at *International Conference on Software Maintenance (ICSM)*, Sept. 2006.

A Framework for Testing Security Mechanisms for Program-Based Attacks, presented at *Software Engineering for Secure Systems (SESS)*, co-located with the *International Conference on Software Engineering (ICSE)*, May 2005.

Online Impact Analysis via Dynamic Compilation Technology, presented at the *International Conference on Software Maintenance*, Sept. 2004.

Online Impact Analysis via Dynamic Compilers, 30 minute seminar given at *Special Interest Group on Program Analysis and Compiler Techniques - University of Delaware*, December 2003.

Musings on Partial Inlining, 30 minute seminar given at *Special Interest Group on Program Analysis and Compiler Techniques - University of Delaware*, March, 2001.

Introduction to UNIX, 60 minute seminar given at *Department of Mathematics and Computer Science Colloquium - Shippensburg University, Shippensburg, PA*, February 1998.

Poster Presentations

B. Breech, M.L. Goldstein, A. Roberts and A. Usmanov, **First Steps Towards a Simplified Transport Model for Sub-Alfvénic Flows in the Corona**, *Solar Wind 12*, 2009.

B. Breech, S.R. Cranmer, W.H. Matthaeus, J.C. Kasper and S. Oughton, **Studying the Heating of the Solar Wind Through Electron and Proton Effects**, *Solar Wind 12*, 2009.

B. Breech, W.H. Matthaeus, J. Minnie, J.W. Bieber, S. Oughton, C.W. Smith, and P.A. Isenberg, **Turbulence Transport Throughout the Heliosphere**, *Fall meeting of the American Geophysics Union*, 2007.

Ben Breech, W.H. Matthaeus, P. Dmitruk, A. Bemporad, G. Poletto, M. Velli and M. Romoli, **Density and Magnetic Field Signatures of Interplanetary 1/f Noise**, *Fall meeting of the American Geophysics Union*, 2006.

Ben Breech, W.H. Matthaeus, S. Oughton, J. Minnie, J.W. Bieber, C.W. Smith and P.A. Isenberg, **Turbulence throughout the Heliosphere**, *Fall meeting of the American Geophysical Union*, 2005.

Ben Breech, W.H. Matthaeus, S. Oughton, J. Minnie, J.W. Bieber, C.W. Smith and P.A. Isenberg, **Radial Evolution of Cross Helicity at Low and High Latitudes in the Solar Wind**, *Solar Wind 11*, 2005.

W.H. Matthaeus, B. Breech, J. Minnie, S. Parhi, J. W. Bieber, R. A Burger, S. Oughton, C.W. Smith and P.A. Isenberg, **Effect of Latitudinal Dependence of Boundary Conditions on Transport of Turbulence in the Heliosphere**, *Fall meeting of the American Geophysical Union*, 2004.

B. Breech, W.H. Matthaeus, J. Minnie, S. Parhi, S. Oughton, J. W. Bieber, and B. Bavassano, **Radial Evolution of Cross Helicity in the Solar Wind at High Latitudes: Ulysses Observations and Turbulence Modeling Results**. *Fall meeting of the American Geophysical Union*, 2004.

S. Parhi, J. Minnie, B. Breech, J.W. Bieber, W.H. Matthaeus, and R.A. Burger, **Transport of Turbulence Throughout the Heliosphere and Determining its Impact on Solar Modulation of Cosmic Rays**, *Fall meeting of the American Geophysical Union*, 2004.

B.Breech,L.J. Milano, W.H. Matthaeus, and C.W. Smith, **Induced Electric Field and Cross Helicity in Solar Wind Fluctuations**, *Fall meeting of the American Geophysical Union*, 2003.

B.Breech, L.J. Milano, W.H. Matthaeus, and C.W. Smith, **Electric Field Statistics in the Solar Wind**, *Solar Wind 10*, Summer 2002.

B.Breech, L.J. Milano, W.H. Matthaeus, and C.W. Smith, **One-Point Electric Field Statistics in the Solar Wind**, *Fall meeting of the American Geophysical Union*, 2002.

Professional Experience

Postdoctoral Researcher: September 2008 to present.

NASA Goddard Space Flight Center.

Advisor: Dr. Melvyn L. Goldstein.

Research focuses primarily on developing models describing the sub-Alfvénic flows emanating from the solar surface through the corona. Additional topics include exploring electron effects on turbulent heating, and improving hybrid particle-fluid code for large scale plasma physics simulations.

Research Assistant: June 2001 to August 2003, August 2004 to August 2005.

Department of Physics and Astronomy, University of Delaware.

Advisor: Dr. William H. Matthaeus.

This research focused on a variety of topics in solar wind turbulence, including computing the distribution functions for the induced electric field, turbulence transport throughout the heliosphere and data analysis for the Ulysses spacecraft.

Research Assistant: February 1999 to December 1999.

Department of Computer and Information Sciences, University of Delaware.

Advisor: Dr. Lori L. Pollock.

This research focused on region-based compilation techniques for improved program optimization.

Networking and Systems Administrator: June 1995 to January 2004.

Cumberland Valley Networking Services, Shippensburg, Pennsylvania.

Responsible for day-to-day system operations of network servers, modem pools, DSL connections, routers and internet connection for an internet service provider.

Computer Center Assistant: June 1995 to August 1998

Shippensburg University, Shippensburg, Pennsylvania.

Responsible for fixing user problems, campus modem pool, upgrading campus web server, configuring the campus firewall and some campus network servers.

Professional and Service Activities

Technical Paper Reviewer:

ACM SIGPLAN Programming Language Design and Implementation (PLDI)

Journal on Software Practice and Experience

ACM Transactions on Programming Languages and Systems (TOPLAS)

Proceedings of Solar Wind 10

Organizer, Regional Programming Contests: Spring 1999, Spring 2000, Fall 2000 - 2008.

Organized and ran programming competitions for 20-50 undergraduate students from 5-10 colleges/universities, in PA, NJ, DE and MD, using C/C++ and Java. Responsible for writing problems, judging student submissions and other logistical issues.

President, Graduate Student Association Summer 2003 - Winter 2005 Computer and Information Sciences Department, University of Delaware. Responsible for bringing graduate student issues to the faculty, and improving the graduate student community.

Organizing Committee: Mid-Atlantic Student Workshop on Programming Languages and Systems (MASPLAS) held at the University of Delaware, Spring 2000, Spring 2005.

Member, Association for Computing Machinery (ACM). 1997 to 2008.

Member, Institute of Electrical and Electronics Engineers (IEEE). Summer 2004 to 2008.

Member, American Geophysical Union (AGU). 2002 to present.

Member, American Physics Society (APS), 2006 to present.