Patrick Shipman

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General Information

Born 1977 in Tucson, AZ, USA
Citizen of the United States of America and the Federal Republic of Germany

Research Interests

- PDE models of pattern formation, particularly in biological systems
- Mathematical modeling of biological materials and growth in biological systems
- Geometry of PDE
- Mathematical epidemiology and linguistics

Education

2004 Ph.D. in Mathematics, University of Arizona
Advisor: Alan Newell

1999 B.S., Mathematics and B.A., Linguistics, University of Arizona

Employment

August 2008- Assistant Professor, Department of Mathematics
Colorado State University

October 2005 -present National Science Foundation Mathematical Sciences Postdoctoral Fellow

Host Insitution:
August 2006- present: University of Maryland, Department of Mathematics
Sponsor: Stuart Antman
October 2005-July 2006: Max-Planck-Institute for Mathematics in the Sciences
Sponsor: Stefan Müller

September 2004 -October 2005 Postdoctoral Associate, Max-Planck-Institute for Mathematics in the Sciences
Leipzig, Germany

June 1997- May 1999 Research in the laboratory of Dr. Neil Mendelson,
University of Arizona Department of Molecular and Cellular Biology

Fellowships and Grants

Spring, Fall 2001, Fall 2002, Fall 2003	National Science Foundation VIGRE Fellowship via the University of Arizona Department of Mathematics
1999-2000	National Science Foundation IGERT and Flinn Foundation Biomathematics Graduate Fellowship
1997 – 1999	Graesser Foundation Mathematics Scholarship
1995 – 1999	National Merit Scholar
1995 – 1999	Byrd Scholar
1995 – 1999	University of Arizona President's Award for Excellence Tuition Waiver
1995 – 1996	National Science Scholars Scholarship (United States Department of Education)

Service

Fall 2007- Spring 2008.	Member, University of Maryland Educational Affairs Committee
Spring and Fall 2007.	Member, Biology Calculus Steering Committee, University of Maryland
Spring and Fall 2002.	Organizer, University of Arizona Graduate Mathematics Colloquium

Reviewer for *Physica D*, *Physical Review Letters*, and *Journal of Theoretical Biology*

Awards

1999	University of Arizona Department of Mathematics Outstanding Senior Award
1996	First Place in the University of Arizona English Department Essay Competition
1996	University of Arizona German Studies Department Outstanding Student
1995	Arizona Language Foundation Outstanding Foreign Language Student Scholarship

Teaching Experience

Fall 2000 Teaching Training Course, University of Arizona Mathematics Department

August 1999 Teaching Training Workshop, University of Arizona Graduate College

- Course Instructor of the following courses at the University of Maryland:

Spring 2008	Multivariate Calculus, Linear Algebra, and Differential Equations II (Honors course)
Fall 2007	Multivariate Calculus, Linear Algebra, and Differential Equations I (Honors course)
Spring 2007	Introduction to Analysis
Fall 2006	Calculus I (Honors course)

- Course Instructor of the following courses at the University of Arizona:

Spring 2004	Math in Modern Society
Spring 2003	Calculus I
Summer 2001	Elements of Calculus
Fall 2000	Trigonometry

- Teaching Assistant for the following courses at the University of Arizona:

Spring 2003	Methods in Applied Mathematics (Graduate-Level)
Spring 2002	Linear Algebra (Junior/Senior-Level)
Spring 2002	Introductory Ordinary Differential Equations
Fall 2001	Intermediate Dynamical Systems and Chaos
Fall 2001	Complex Analysis (Graduate-Level)

- Summer 2004 Assistant for the University of Arizona Mathematics Department's 5-Day Integration Workshop for incoming graduate students.

- Organizer and presenter, together with other graduate students, of day-long workshops for high school students on the following topics:

Spring 2003	Elasticity
Fall 2002, Spring 2003	Graph Theory
Fall 2001, Spring 2004	Knot Theory

Selected Talks

February 2008	*Growth and Symmetry: Pattern Formation on Plants* University of Delaware, Mathematics Recruitment Talk
February 2008	*Growth and Symmetry: Pattern Formation on Plants* University of Maryland-Baltimore County, Mathematics Recruitment Talk
February 2008	*Growth and Symmetry: Pattern Formation on Plants* Colorado State University, Mathematics Recruitment Talk
February 2008	*Growth and Symmetry: Pattern Formation on Plants* Michigan State University, Mathematics Recruitment Talk
January 2008	*Growth and Symmetry: Pattern Formation on Plants* University of Minnesota, Mathematics Recruitment Talk
January 2008	*Growth and Symmetry: Pattern Formation on Plants* Ohio State University, Mathematics Recruitment Talk
January 2008	*Growth and Symmetry: Pattern Formation on Plants* University of Utah, Mathematics Recruitment Talk
January 2008	*Phyllotaxis: Competition and Cooperation Between Biochemical and Biomechanical Processes* University of Utah, Biomath Seminar
December 2007	*Growth and Symmetry: Pattern Formation on Plants* University of California, Irvine, Mathematics Recruitment Talk
September 2007	*Growth of Self-Similar Structures* **(invited)** Tucson Workshop on Growth
January 2007	*An Amplitude Equation Approach to Phyllotaxis* **(invited)** AMS Meeting, New Orleans
June 2006	*Elasticity and Plasticity in Plant Patterns* **(invited)** University of Bayreuth, Department of Physics
October 2005	*Polygonal Planforms on Plants* **(invited)** PhysBio 2005, St. Etienne de Tineè, France
October 2005	*Polygonal Planforms on Plants* **(invited)** Max Planck Institute for Dynamics and Complex Systems Göttingen, Germany
July 2005	*Macrostructure and Microstructure in Plant Primodia Formation* European Conference on Mathematical and Theoretical Biology Dresden, Germany
May 2005	*Polygonal Planforms on Plants* **(invited)** Technical University of Chemnitz, Department of Physics
March 2005	*Polygonal Planforms on Plants* **(invited)** Harvard University, Division of Engineering and Applied Sciences
November 2003	*Ridges, Hexagons, and Phyllotaxis on Plants* **(invited)** Thematic Program on Partial Differential Equations, Workshop on Patterns in Physics The Fields Institute for Mathematical Research, Toronto, Canada
September 2003	*Plant Morphology and Gauss's* Theorema Egregium **(invited)** International Seminar and Workshop on Pattern Formation: From Amplitude Equations to Applications. Max-Planck Institute for the Physics of Complex Systems, Dresden, Germany
August 2003	*Phyllotactic Patterns on Plants* KITP Conference on Pattern Formation in Physics and Biology Kavli Institute for Theoretical Physics, Santa Barbara, CA
October 1999	*Dynamics of Helical Strips* Four Corners Section Meeting of the American Physical Society, Tucson, AZ

Symposium Organization

May 2008 Co-organizer, with Isaac Chenchiah,
Minisymposium: Structure and Growth in Biology
SIAM Conference on Mathematical Aspects of Materials Science

Workshops and Summer Schools Attended

April 2006 Workshop on Mathematics and Materials, University of Rome

March 2006 Leipzig Workshop on Linguistic Diversity
Max Planck Institute for Evolutionary Anthropology, Leipzig

November 2003 Visitor at the Kavli Insitute for Theoretical Physics, University of California at Santa Barbara for the Program in Pattern Formation in Physics and Biology

June-July 1999 Math and Language Study at the University of Ulm, Germany

August 1998 Music and Language Study at the University of Bayreuth, Germany

Publications

◦ P. D. Shipman. Self-similarity and invariance in phyllotactic tilings. submitted 2007.

• A. C. Newell, P. D. Shipman. A new invariant in plant phyllotaxis. *Journal of Analysis and its Applications*, accepted 2008.

• H. Tuckwell, P. D. Shipman, A. S. Perelson. The probability of HIV infection in a new host and its reduction with microbicides. *Mathematical Biosciences*, accepted 2008.

• P. Guha, P. D. Shipman. The polarized Hessian covariant: Contribution to pattern formation in the Föppl-von Kármán equations. *Chaos, Solitons, Fractals*, accepted 2007.

• A. C. Newell, P. D. Shipman, and Z. Sun. Phyllotaxis: Cooperation and competition between mechanical and biochemical processes. *Journal of Theoretical Biology*, doi: 10.1016/j.jtbi.2007.11.036, 2007.

• A. C. Newell, P. D. Shipman. Plants and Fibonacci. *Journal of Statistical Physics* **121** (5-6), 937-968, 2005.

• P. D. Shipman, A. C. Newell. Polygonal Planforms and Phyllotaxis on Plants. *Journal of Theoretical Biology* **236**, 154-197, 2005.

• M. Kücken, A. C. Newell, P. D. Shipman. Mean Creep: The Soft Mode in Elastic Sheet Buckling. *Physica D* **205**, 181-188, 2005.

• P. D. Shipman, A. C. Newell. Phyllotactic Patterns on Plants. *Physical Review Letters* **96**, 168102, 2004*.

* Article featured in E. Klarreich. Cactus Patterns Buckle Up. *Physical Review Focus*, April 2004; K. Krieger. Spiraling into Form. *Science Now*, May 2004; A. Stone. Fibonacci Cactus. *Discover.com*, July 2004; A. Ananthaswamy. Spiral Pattern Helps Cacti Deal with Stress. *New Scientist*, May 2004.

• N. H. Mendelson, P. Shipman, D. Roy, L. Chen, J. J. Thwaites. The Dynamic Behavior of Bacterial Macrofibers Growing with One End Prevented from Rotating. *BMC Microbiology* **3** (18), 2003.

• A. Goriely, P. Shipman. Dynamics of Helical Strips. *Physical Review E* **61** (4), 4508-4517, 2000.

• P. Shipman. Spontaneous Perversion of Elastic Filaments. Research Report in *The Nonlinear Journal*, **2**, www.math.arizona.edu/∼ goriely, 2000.

• P. Shipman. Essay on Fractals. In *The Student's Guide to First-Year Composition*, Burgess Publishing Company, 1996.

In Preparation

• R. Chirat, P. D. Shipman. Beach-like patterns on sea shells.

• P. D. Shipman, S. Faria. A simple model of vowel chain shift.

• H. Tuckwell, P. D. Shipman. Distributions of dynamical properties in viral networks.

• T. Cooke, P. D. Shipman. Patterns at cactus meristems: Multiple modes of initiation.