

ANDREW L. BELMONTE

Curriculum Vitae

W. G. Pritchard Laboratories
Department of Mathematics
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Academic Employment and Positions

- 2007 Visiting Professor, School of Engineering and Applied Sciences, Harvard University
- 2004 – Associate Professor, Department of Mathematics, Pennsylvania State University
- 2004 Professeur Invité, Ecole Supérieure de Physique et Chimie Industrielles, Paris
- 1998 – 2004 Assistant Professor, Department of Mathematics, Pennsylvania State University
- 1996 – 1998 Postdoctoral Associate, Department of Physics, University of Pittsburgh
- 1994 – 1996 Postdoctoral Associate, CNRS Institut Non-Linéaire de Nice, France

Education

- 1994 Ph.D. Princeton University, Physics
Dissertation Title: “Boundary Layer Measurements in Thermal Turbulence: Vertical Plumes in a Horizontal Wind.”
Thesis Advisor: Albert Libchaber
- 1991 M. A. Princeton University, Physics
- 1988 B. A. The University of Chicago (*with Honors*)

Grants and Awards

- 2001 – 2006 NSF CAREER Grant (DMR-0094167).
- 2004 George W. Atherton Award for Excellence in Teaching (Penn State).
- 2003 C. I. Noll Award for Excellence in Teaching (College of Science, Penn State).
- 2002 – 2004 NSF SCREMS Grant, co-PI (DMS-0215392).
- 2000 – 2002 Alfred P. Sloan Foundation Research Fellowship.
- 2000 – 2001 President’s Fund for Undergraduate Research (Penn State).

Publications

(p)reprints available at <http://www.math.psu.edu/belmonte/papers.html>

- 2007 AB, “The tangled web of self-tying knots”, *Proceedings of the National Academy of Sciences* **104**, 17243–17244.
- 2007 T. Grumstrup and AB, “Elastic splash of two Newtonian liquids”, *Physics of Fluids* **19**, 091109 [2006 Gallery of Fluid Motion].
- 2007 T. Grumstrup, J. B. Keller, and AB, “Cavity ripples observed during the impact of solid objects into liquids”, *Physical Review Letters* **99**, 114502(1–4).
- 2007 T. Podgorski, M. Sostarecz, S. Zorman, and AB, “Fingering instabilities of a reactive micellar interface”, *Physical Review E* **76**, 016202(1–6).
- 2007 J. R. Gladden and AB, “Motion of a viscoelastic micellar fluid around a cylinder: flow and fracture”, *Physical Review Letters* **98**, 224501(1–4).
- 2006 L. B. Smolka and AB, “Charge screening effects on filament dynamics in xanthan gum solutions”, *Journal of Non-Newtonian Fluid Mechanics* **137**, 103–109.

- 2006 B. Akers and AB, “Impact dynamics of a solid sphere falling into a viscoelastic micellar fluid”, *Journal of Non-Newtonian Fluid Mechanics* **135**, 97–108.
- 2005 J. R. Gladden, N. Z. Handzy, AB, and E. Villermaux “Dynamic buckling and fragmentation in brittle rods”, *Physical Review Letters* **94**, 35503(1–4).
- 2004 M. C. Sostarecz and AB, “Bead-on-string phenomena in wormlike micellar fluids”, *Physics of Fluids* **16**, L67–L70.
- 2004 L. B. Smolka, AB, D. M. Henderson, and T. P. Witelski, “Exact solution for the extensional flow of a viscoelastic filament”, *European Journal of Applied Mathematics* **15**, 679–712.
- 2004 N. Z. Handzy and AB, “Oscillatory rise of bubbles in wormlike micellar fluids with different microstructures”, *Physical Review Letters* **92**, 124501(1–4).
- 2004 T. Podgorski and AB, “Surface folding of viscoelastic fluids: finite elasticity membrane model”, *European Journal of Applied Mathematics* **15**, 385–408.
- 2003 M. C. Sostarecz and AB, “Motion and shape of a viscoelastic drop falling through a viscous fluid”, *Journal of Fluid Mechanics* **497**, 235–252.
- 2003 L. B. Smolka and AB, “Drop pinch-off and filament dynamics of wormlike micellar fluids”, *Journal of Non-Newtonian Fluid Mechanics* **115**, 1–25.
- 2003 M. C. Sostarecz and AB, “Dynamics inside polymer drops: from dimple to Rayleigh instability to torus”, *Physics of Fluids* **15**, S5 [2002 Gallery of Fluid Motion].
- 2003 A. Jayaraman and AB, “Oscillations of a solid sphere falling through a wormlike micellar fluid”, *Physical Review E* **67**, 65301–4.
- 2002 T. Podgorski and AB, “Surface folds during the penetration of a viscoelastic fluid by a sphere”, *Journal of Fluid Mechanics* **460**, 337–348.
- 2001 AB, J. T. Jacobsen, and A. Jayaraman, “Monotone solutions of a nonautonomous differential equation for a sedimenting sphere”, *Electronic Journal of Differential Equations* **2001** No. 62, 1–17.
- 2001 AB, M. J. Shelley, S. T. Eldakar, and C. H. Wiggins, “Dynamic Patterns and Self-Knotting of a Driven Hanging Chain”, *Physical Review Letters* **87**, 114301–4.
- 2000 AB, “Self-oscillations of a cusped bubble rising through a micellar fluid”, *Rheologica Acta* **39**, 554–559.
- 2000 R. Tóth, V. Gáspár, AB, M. C. O’Connell, A. Taylor, and S. K. Scott, “Wave initiation in the ferroin-catalysed Belousov-Zhabotinsky reaction with visible light”, *Physical Chemistry Chemical Physics* **2**, 413–416.
- 2000 AB, B. Martin, and W. I. Goldburg, “Experimental study of Taylor’s hypothesis in a turbulent soap film”, *Physics of Fluids* **12**, 835–845.
- 1999 AB and E. Moses, “Flutter and Tumble in Fluids”, *Physics World* **12**, 21–25 (April).
- 1999 AB, W. I. Goldburg, H. Kellay, M. Rutgers, B. Martin, and X-L. Wu, “Velocity Fluctuations in a Turbulent Soap Film: The Third Moment in Two Dimensions”, *Physics of Fluids* **11**, 1196–1200.
- 1998 AB, H. Eisenberg, and E. Moses, “From Flutter to Tumble: Inertial Drag and Froude Similarity in Falling Paper”, *Physical Review Letters* **81**, 345–348.

- 1998 W. I. Goldburg, AB, X-L. Wu, and I. Zusman, "Flowing Soap Films: a Laboratory for Studying Two-Dimensional Hydrodynamics", *Physica A* **254**, 231–247.
- 1998 M. Rivera, AB, W. I. Goldburg, X-L. Wu, and H. Kellay, "Optical Fiber Velocimetry: A Technique for Measuring Velocity in Two Dimensional Flows", *Review of Scientific Instruments* **69**, 3215–3222.
- 1998 J.-M. Flesselles, AB, and V. Gáspár, "Dispersion Relation for Waves in the Belousov-Zhabotinsky Reaction", *J. Chemical Society Faraday Transactions* **94**, 851–856.
- 1997 AB, Q. Ouyang, and J.-M. Flesselles, "Experimental Survey of Spiral Dynamics in the Belousov-Zhabotinsky Reaction", *Journal de Physique II (France)* **7**, 1425–1468.
- 1996 AB, J.-M. Flesselles, and Q. Ouyang "Spiral Instability to Line Sources in Forced Chemical Pattern Turbulence", *Europhysics Letters* **35**, 665–670.
- 1996 AB and A. Libchaber, "Thermal Signature of Plumes in Turbulent Convection: The Skewness of the Derivative", *Physical Review E* **53**, 4893–4898.
- 1996 AB and J.-M. Flesselles, "Experimental Determination of the Dispersion Relation for Spiral Waves", *Physical Review Letters* **77**, 1174–1177.
- 1995 AB and J.-M. Flesselles, "Non-Steady Behaviour of a Spiral in a Constant Current", *Europhysics Letters* **32**, 267–272.
- 1995 AB, A. Tilgner, and A. Libchaber, "Turbulence and Internal Waves in Side-Heated Convection", *Physical Review E* **51**, 5681–5687.
- 1994 AB, A. Tilgner, and A. Libchaber, "Temperature and Velocity Boundary Layers in Turbulent Convection", *Physical Review E* **50**, 269–279.
- 1993 AB, A. Tilgner, and A. Libchaber, "Boundary Layer Length Scales in Thermal Turbulence", *Physical Review Letters* **70**, 4067–4070.
- 1993 A. Tilgner, AB, and A. Libchaber, "Temperature and Velocity Profiles of Turbulent Convection in Water", *Physical Review E* **47**, 2253–2256.
- 1991 E. Eikenberry, M. Tate, AB, J. Lowrance, D. Bilderback, and S. Gruner, "A Direct-Coupled Detector for Synchrotron X-Rays Using a Large Format CCD", *IEEE Transactions on Nuclear Science* **38**, 110–118.
- 1988 AB, M. J. Vinson, J. A. Glazier, G. H. Gunaratne, and B. G. Kenney, "Trajectory Scaling Functions at the Onset of Chaos: Experimental Results", *Physical Review Letters* **61**, 539–542.

Graduate Students (current)

Andong He - viscoelastic instabilities in waves (Ph.D. student).

Michael Higley - stochastic modeling of fragmentation (Ph.D. student).

Past Graduate Students

Nestor Z. Handzy: Ph.D. March 2005, "Experimental Observations and Mathematical Description of Micellar Fluid Flow."

Subsequent position: Postdoctoral Associate, Weizmann Institute, Israel.

Michael C. Sostarecz: Ph.D. August 2004, “Experiments and Modeling of Dimpled Drops and Beaded Filaments in Viscoelastic Fluids.”

Present position: Visiting Assistant Professor, Dept of Physics, Monmouth College, IL.

Linda B. Smolka (coadvisor with D. M. Henderson): Ph.D. November 2001, “On the Motion of Newtonian and Non-Newtonian Liquid Filaments: Stretching, Beading, Blistering, Pinching.”

Present position: Assistant Professor, Dept of Mathematics, Bucknell University.

Past Postdoctoral Associates

Josh Gladden (Ph.D. Penn State Univ. 2003), August 2003 - June 2005.

Subsequent position: Assistant Professor, Dept of Physics, University of Mississippi.

Jon T. Jacobsen (Ph.D. Univ. Utah 1999), August 1999 - May 2002.

Subsequent position: Assistant Professor, Dept of Mathematics, Harvey Mudd College.

Thomas Podgorski (Ph.D. ESPCI, Paris 2000), November 2000 - October 2002.

Subsequent position: CNRS, Université Joseph Fourier, Grenoble, France.

Anandhan Jayaraman (Ph.D. Univ. Pittsburgh 1999), August 1999 - July 2002.

Subsequent position: Postdoctoral Associate, Dept of Physics, Duke University.

Undergraduate Students Mentored (Pritchard Lab projects)

Over 20 undergraduate research projects, including:

- Michael S. Willis: Math major (Fall 2004); Honors Thesis, *Moving A String* (Dec. 2004).
- Benjamin F. Akers: Math major (2002-2003).
 - work on impact in viscoelastic fluids published in *J. Non-Newtonian Fluid Mech.* (2006).
- Andrea Young: Math major (2000-2001); Honors Thesis, *Flapping Flags and Conformal Mappings* (Dec. 2001).
- Shaden Eldakar: Psychology / pre-med major (1999-2001).
 - work on dynamics of a driven hanging chain published in *Phys. Rev. Lett.* (2001).
- Megan C. O’Connell: Math major (1998-1999).
 - work on laser-induced chemical waves published in *Phys. Chem. Chem. Phys.* (2000).

Courses Taught

Department of Mathematics, Pennsylvania State University

Graduate MATH 580: Introduction to Applied Mathematics (F-2004, F-2003); PHYS 517: Statistical Mechanics (S-2002); MATH 505: Mathematical Fluid Dynamics (F-2007, S-2001, F-1999).

Undergraduate MATH 450: Mathematical Modeling of the Physical World (F-2005, F-2000); MATH 497C: Mathematical Analysis of Fluid Flow - Honors Analysis Course (F-2001); MATH 412: Partial Differential Equations (S-2008, S-2003, F-2000); MATH 406: Applied Complex Analysis - Advanced Calculus for Engineers/Scientists II (S-2006, S-2005, S-2004); MATH 405: Advanced Calculus for Engineers/Scientists I (F-2006); MATH 231: Multivariable Calculus (S-2008); PSU 016: First Year Seminar in Math (F-1999, S-2000); MATH 140B-141B: Calculus with Applications in Biology (F-1998, S-1999); MATH 140: Calculus I (F-1998).

Summer Schools and Special Institutes

Les Houches Winter School - Fluid Foam Physics, Ecole de Physique, Les Houches (2006).

Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution (5 summers: 2003 – 07).
Complex Systems Summer School, Santa Fe Institute (2 summers: 2002 – 03).

Department of Physics, University of Pittsburgh

1996 – 1997 Physics 1170: Introduction to Quantum Mechanics.

Reviewer

Colloids and Surfaces, Journal of Fluid Mechanics, Journal of Non-Newtonian Fluid Mechanics,
Physical Review Letters, Physics of Fluids, Proceedings of the National Academy of Sciences.

Invited Seminars and Invited Talks (since 2004)

- Jan. 2008 Institute for the Investigation of Materials, Universidad Nacional Autónoma de México, Mexico City, MEXICO – Colloquium: *Bouncing Drops and Elastic Splashes: Soft Materials with Active Surfaces.*
- Nov. 2007 Dept. of Physics, Philipps-Universität Marburg, GERMANY – Complex Systems Seminar: *Standing Waves on Moving Bubbles.*
- Nov. 2007 Mini-Workshop on Fluid-Solid Interactions, Mathematisches Forschungsinstitut, Oberwolfach, GERMANY: *Experimental Observations of Sedimentation in Complex Fluids.*
- Sept. 2007 Symposium in Honor of the 80th Birthday of Walter Goldburg, University of Pittsburgh, PA: *Standing Waves on Moving Bubbles.*
- Sept. 2007 Dept. of Mathematics, University of Michigan, Ann Arbor, MI – Applied and Interdisciplinary Mathematics Seminar: *Acoustic ripples on long entrained bubbles.*
- Aug. 2007 Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution, Woods Hole, MA: *Coalescence of Charged Water Droplets.*
- April 2007 Dept. of Mathematics, Massachusetts Institute of Technology – Physical Mathematics Seminar: *Acoustic Ripples and Elastic Splashes.*
- Jan. 2007 Dept. of Applied Mathematics and Engineering Sciences, Northwestern University – Colloquium: *Deep and Shallow Impact: Acoustic Ripples and Elastic Splashes.*
- Sept. 2006 Dept. of Physics, Lehigh University, Bethlehem, PA – Biomechanics Seminar: *Shattered Spaghetti and Healing Gels: Tales of Stress and Relaxation.*
- Aug. 2006 Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution, Woods Hole, MA: *Cavity Ripples in Water.*
- March 2006 IUTAM Symposium on Interactions for Dispersed Systems in Newtonian and Viscoelastic Fluids, Guanajuato, MEXICO: *Motion of spheres and cylinders through viscoelastic micellar fluids.*
- Feb. 2006 Dept. of Physics, Johns Hopkins University, MD – Colloquium: *What Gives? Soft Condensed Matter at the Breaking Point.*
- Jan. 2006 Dept. of Mathematics, Max Planck Institute for Mathematics, Leipzig, GERMANY – Applied Mathematics Seminar: *Breaking noodles under impact: stress and buckling in brittle rods.*
- Oct. 2005 Dept. of Mathematics, University of Michigan, Ann Arbor, MI – Applied and Interdisciplinary Mathematics Seminar: *Breaking spaghetti by impact: stress and buckling in brittle rods.*

- Oct. 2005 Workshop in Visco-plastic fluids: from Theory to Application, Banff International Research Station, CANADA: *Reaction Models for Wormlike Micellar Fluids; From Flow to Tear in a Wormlike Micellar Gel.*
- July 2005 Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution, Woods Hole, MA: *Fast times and fine pasta: stress waves, buckling, and breaking.*
- May 2005 Conference on Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology: *Surface fracture in viscoelastic micellar fluids.* (Invited talk)
- Nov. 2004 École Supérieure de Physique et Chimie Industrielles, Paris, FRANCE – Seminaire de Laboratoire PMMH: *Cratères Viscoélastiques dans les Fluides Micellaires.*
- Nov. 2004 Université Joseph Fourier, Grenoble, FRANCE – Soft Matter / Grey Matter Seminar: *Cratères Viscoélastiques.*
- July 2004 Geophysical Fluid Dynamics Program, Woods Hole Oceanographic Institution, Woods Hole, MA: *Viscoelastic Craters.*
- May 2004 Dept. of Physics, University of Texas, Austin – Nonlinear Dynamics Seminar: *Dimpling and Buckling Instabilities of Viscoelastic Free Surfaces.*
- May 2004 Dept. of Mechanical Engineering, Massachusetts Institute of Technology – Fluid Mechanics Seminar: *Bubbles and Beads in a “Tunable” Viscoelastic Fluid.*
- March 2004 Dept. of Mathematics, Massachusetts Institute of Technology – Physical Mathematics Seminar: *Dimpling and Buckling of Viscoelastic Free Surfaces.*
- March 2004 Center for Nonlinear and Complex Systems, Duke University – Nonlinear Seminar: *Learning by Dropping: Motion in Self-Assembling Elastic Fluids.*
- Feb. 2004 Dept. of Mathematics, University of Utah – Colloquium: *From Jumping Bubbles to Spontaneous Knots: Tales from a Math Lab.*
- Jan. 2004 Courant Institute, New York University – Applied Math Lab Seminar: *New Instabilities of Viscoelastic Free Surfaces.*

Book Chapters / Conference Proceedings

- 2005 AB, “Knot dynamics in a driven hanging chain: experimental results”, Chapter 4 in *Physical and Numerical Models in Knot Theory*, Series on Knots and Everything Vol. 36, (World Scientific Publishing Co).
- 2000 AB and A. Libchaber, “Images of Hard Turbulence: Buoyant Plumes in a Cross-wind”, in *Geophysical and Astrophysical Convection: 1995 Conference Proceedings*, (Gordon and Breach Science Publishers, Amsterdam).
- 1998 AB, “Buoyant Plumes and Internal Waves: Two Experiments in Turbulent Convection”, in *Turbulence at Ultra-High Rayleigh and Reynolds Numbers: A Status Report*, R. J. Donnelly and K. R. Sreenivasan, eds. (Springer, New York).
- 1995 A. Tilgner, AB, and A. Libchaber, “Rayleigh-Bénard Turbulent Convection”, in *Turbulence: A Tentative Dictionary*, P. Tabeling and O. Cardoso, eds. (Plenum Press, New York).

Invited Participation / Poster Presentation in International Conferences (since 2003)

- Nov. 2005 NSF-MRSEC Workshop: Focusing Stress in a Soft Interface, University of Chicago – Chicago, IL: *Cutting a Micellar Gel.*

- Dec. 2004 National Academy of Sciences 7th Annual Symposium on Japanese-American Frontiers of Science – Irvine, CA: *Dynamics of Thin Flexible Things: Shaking & Breaking*.
- Jan. 2004 National Academy of Sciences Convocation on Facilitating Interdisciplinary Research – Washington, DC: *Interdisciplinary within a Discipline: Experimental Laboratories in Mathematics Departments*.
- Dec. 2003 National Academy of Sciences 6th Annual Symposium on Japanese-American Frontiers of Science – Shonan, JAPAN: *Hydrodynamic Instabilities of Micellar Fluids*.

Invited Visits

- School of Engineering and Applied Sciences, Harvard University: Jan.–July 2007 (6 months).
- Les Houches School of Physics, France: January 2006 (11 days).
- Woods Hole Oceanographic Institution, Massachusetts: Aug. 2007 (1 week); August 2006 (1 week); July 2005 (2 weeks); July 2004 (1 week); July 2003 (2 weeks).
- Laboratoire de Physique et Mécanique des Milieux Hétérogènes, École Supérieure de Physique et Chimie Industrielles, Paris, France: November 2004 (1 month).
- Santa Fe Institute, New Mexico: June - July 2003 (1 month); June - July 2002 (1 month).
- Courant Institute, New York University: May 1998 (1 week).
- Weizmann Institute of Science, Israel: April 1997 (1 week), January 1996 (2 weeks).

National and International Organizing Committee Service

- Program Committee, Division of Fluid Dynamics, American Physical Society (2007-2010).
- Organizer, Focus Session: *Rheology and Hydrodynamics of Wormlike Micellar Fluids*, Annual Meeting of the American Physical Society (March 2007).
- National Academy of Sciences Symposium on Japanese-American Frontiers of Science (2003-2004).

Present Committee Service

- Dept Graduate Admissions (2006-08); Ph.D. Committee for Longhua Jiang; J. Ye, advisor (physics).

Past Committee Service

- College of Science Vision (2004-2005); Departmental Computer (2002-2006); Math Biology Search (2005-2006); Departmental Policy (2001-2004); Undergraduate Studies (1999-2002); Graduate Teaching Assistant (2001); Mathematics Chair Search (2000, 2006).
- 8 Ph.D. Committees in: Aerospace Engineering (1), Chemical Engineering (1), Engineering Science & Mechanics (2), Mathematics (2), Physics (2).

Outreach Activities

- Undergraduate Research in the Pritchard Labs (ongoing):
<http://www.math.psu.edu/belmonte/studentR.html>
- NSF CAREER grant outreach:
- Research Experiences for Secondary School Teachers (2001-2006).
 - Weekend Workshops in Experiments and Equations (2003-2004).
- High School Math Club, State College (2000-2002).