

## **Paul W. Fontana, Ph.D.**

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### **EDUCATION:**

Ph.D., physics, University of Wisconsin–Madison, Madison, WI, 1999. Research in experimental plasma physics (fusion). Dissertation title: “Ion Dynamics and the Dynamo in the Edge of the Reversed-Field Pinch.”

M.S., physics, minor in mathematics, University of Wisconsin–Madison, Madison, WI, 1994.

B.S., physics and mathematics, The Honors College, Michigan State University, East Lansing, MI, 1991.

B.A., French, The Honors College, Michigan State University, East Lansing, MI, 1991.

Certificat d’Etudes Françaises, L’Institut d’Etudes Françaises de Touraine, Université de Tours, Tours, France, 1988.

### **EMPLOYMENT:**

2008-present Associate Professor of Physics, Seattle University, Seattle, Washington.

2002-2008 Assistant Professor of Physics, Seattle University, Seattle, Washington.

2001-2002 Director of Laboratories and Visiting Assistant Professor of Physics, Lawrence University, Appleton, Wisconsin.

1999-2001 Lecturer in Physics and Supervisor of Laboratories, Lawrence University, Appleton, Wisconsin.

Fall 1998 Instructor of Physics, Department of Natural Sciences, Edgewood College, Madison, Wisconsin.

1993-1999 Research Assistant, Plasma Physics group, Physics Department, University of Wisconsin – Madison, Madison, Wisconsin.

1992-1993 Teaching Assistant, Department of Physics, University of Wisconsin – Madison, Madison, Wisconsin.

1991-1992 Teaching *Assistant*, employed by le Ministère de l’Éducation nationale de la France, Paris, France; worked at Lycée Alain, Le Vésinet, France.

1990-1991 Laboratory Technician, Psychoacoustics, Department of Physics and Astronomy, Michigan State University, East Lansing, Michigan.

Summer 1989 Laboratory Technician, Perceptron, Inc., Plymouth, Michigan.

### **COURSES TAUGHT:**

Seattle University, Seattle, Washington:

Spring ‘11	PHYS 191	Energy
Winter ‘11	PHYS 370	Advanced Physics Laboratory
Fall ‘10	PHYS 122	Electromagnetism
Fall ‘10	PHYS 330	Electromagnetic Field Theory
Spring ‘10	PHYS 206	Modern Physics Laboratory
Spring ‘10	PHYS 121	Mechanics (lecture)
Winter ‘10	PHYS 121	Mechanics
Fall ‘09	PHYS 122	Electromagnetism

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Fall '09	PHYS 410	Advanced Classical Physics
Spring '08	PHYS 206	Modern Physics Laboratory
Spring '08	PHYS 122	Electricity and Magnetism
Winter '08	PHYS 310	Intermediate Mechanics
Spring '07	PHYS 122	Electricity and Magnetism (formerly PHYS 201)
Winter '07	PHYS 370	Advanced Physics Laboratory
Fall '06	PHYS 123	Waves and Optics (formerly PHYS 202)
Spring '06	PHYS 206	Modern Physics Laboratory
Spring '06	PHYS 393	Electromagnetic Waves (formerly PHYS 331)
Winter '06	PHYS 121	Mechanics (formerly PHYS 200)
Winter '06	PHYS 230	Computing Tools for the Physical Sciences
Fall '05	PHYS 330	Electromagnetic Field Theory
Spring '05	PHYS 293	Special Topics: Modern Physics Laboratory
Winter '05	PHYS 230	Computing Tools for the Physical Sciences
Winter '05	PHYS 200	Mechanics
Fall '04	PHYS 202	Waves, Optics, and Thermodynamics
Spring '04	PHYS 230	Computing Tools for the Physical Sciences
Spring '04	PHYS 331	Electromagnetic Waves
Winter '04	PHYS 200	Mechanics
Fall '03	PHYS 202	Waves, Optics, and Thermodynamics
Fall '03	PHYS 330	Electromagnetic Field Theory
Spring '03	PHYS 311	Intermediate Mecchanics II
Spring '03	PHYS 370	Modern Physical Measurement
Winter '03	PHYS 202	Waves, Optics, and Thermodynamics
Fall '02	PHYS 202	Waves, Optics, and Thermodynamics

Lawrence University, Appleton, Wisconsin:

Spring '02	PHYS 160	Principles of Modern Physics laboratory
Spring '02	PHYS 107	Physics of Music laboratory
Winter '02	PHYS 12/150	Principles of Classical Physics laboratory
Winter '02	PHYS 11/130	Foundations of Physics II laboratory
Fall '01	PHYS 10/120	Foundations of Physics I lecture and laboratory
Spring '01	PHYS 599	Tutorial: Advanced Mechanics and Fluid Dynamics
Spring '01	PHYS 13	Principles of Modern Physics laboratory
Winter '01	PHYS 12	Principles of Classical Physics laboratory
Winter '01	PHYS 11	Foundations of Physics II laboratory
Fall '00	PHYS 10	Foundations of Physics 1 lecture and laboratory
Spring '00	PHYS 13	Principles of Classical Physics laboratory
Winter '00	PHYS 12	Principles of Classical Physics laboratory
Winter '00	PHYS 11	Foundations of Physics II laboratory

Edgewood College, Madison, Wisconsin:

Fall '98	PHYS 130F5	General Physics I
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**REFEREED PUBLICATIONS:**

- P. W. Fontana**, M. Kearney-Fischer, S. Rogers, J. V. Ulmen, and S. Windell, "Circular Couette cell for two-dimensional fluid dynamics experiments," *Rev. Sci. Instrum.* **78**(3), 033907 (2007).
- M.R. Stoneking, **P.W. Fontana**, R.L. Sampson, and D.J. Theucks, "Electron Plasmas in a 'Partial' Torus", *Phys. Plasmas* **9**, 766 (2002).
- B.E. Chapman, J. K. Anderson, T. M. Biewer, D. L. Brower, S. Castillo, P. K. Chattopadhyay, C.-S. Chiang, D. Craig, D. J. Den Hartog, G. Fiksel, **P. W. Fontana**, C. B. Forest, S. Gerhardt, A. K. Hansen, D. Holly, Y. Jiang, N. E. Lanier, S. C. Prager, J. C. Reardon, and J. S. Sarff, "Reduced edge instability and improved confinement in the MST reversed-field pinch", *Phys. Rev. Lett.* **87**, 205001 (2001).
- B.E. Chapman, T.M. Biewer, P.K. Chattopadhyay, C.-S. Chiang, D.J. Craig, N.A. Crocker, D.J. Den Hartog, G. Fiksel, **P.W. Fontana**, S.C. Prager, and J.S. Sarff, "Modifications to the edge current profile with auxiliary edge current drive and improved confinement in a reversed-field pinch," *Phys. Plasmas* **7**, 3491 (2000).
- P.W. Fontana**, D.J. Den Hartog, G. Fiksel, and S.C. Prager, "Spectroscopic Observation of Fluctuation-Induced Dynamo in the Edge of the Reversed-Field Pinch," *Phys. Rev. Lett.* **85**, 566 (2000).
- D.J. Den Hartog, J.T. Chapman, D. Craig, G. Fiksel, **P.W. Fontana**, S.C. Prager, and J.S. Sarff, "Measurement of core velocity fluctuations and the dynamo in a reversed-field pinch", *Phys. Plasmas* **6**, 1813 (1999).
- G. Fiksel, D.J. Den Hartog, and **P.W. Fontana**, "An optical probe for local measurements of fast plasma ion dynamics," *Rev. Sci. Instrum.* **69**, 2024 (1998).

**REFEREED TALKS:**

- M.R. Stoneking, **P.W. Fontana**, R.L. Sampson, and D.J. Theuks, "Electron Plasma Confinement in a Partially Toroidal Trap," Non-neutral Plasma Physics IV 2001, in *AIP Conf. Proc.*, 2002, **606**, 671-680.
- D.J. Den Hartog, D. Craig, N.A. Crocker, G. Fiksel, **P.W. Fontana**, A.K. Hansen, C.C. Hegna, S.C. Prager, J.S. Sarff, and the MST GROUP, "Nonlinear Dynamics of the Reversed-Field Pinch: Torques, Dynamo, and Reconnection," Fusion Energy 2000 (*Proc. 18th Int. Conf. Sorrento 2000*), International Atomic Energy Agency, Vienna (2001) (CD-ROM file EXP3/15).
- G. Fiksel, A.F. Almagri, J.K. Anderson, T.M. Biewer, D. L. Brower, C-S. Chiang, B.E. Chapman, J. T. Chapman, D.J. Craig, N.A. Crocker, D.J. Den Hartog, **P.W. Fontana**, C.B. Forest, Y. Jiang, A.K. Hansen, D. Holly, N.E. Lanier, K.A. Mirus, S.C. Prager, J.S. Sarff, U. Shah, J.C. Sprott, M.R. Stoneking, and E. Uchimoto, "Confinement in the RFP: Lundquist Number Scaling, Plasma Flow, and Reduced Transport," Fusion Energy 1998 (*Proc. 17th Int. Conf. Yokohama 1998*), International Atomic Energy Agency, Vienna (2001) (CD-ROM file EX4/5).
- C.C. Hegna, E. Fernandez, G. Fiksel, **P.W. Fontana**, C.B. Forest, R.W. Harvey, C. Letwin, C. McKay, S.C. Prager, J.S. Sarff, A.P. Smirnov, P.W. Terry, E. Uchimoto, "Theoretical Studies on the Role of Flows and Currents in the RFP," Fusion Energy 1998 (*Proc. 17th Int. Conf. Yokohama 1998*), International Atomic Energy Agency, Vienna (2001) (CD-ROM file THP1/10).
- D.J. Den Hartog *et al.*, "Measurement of Core Velocity Fluctuations and the Dynamo in the

Reversed-Field-Pinch," *Bull. Amer. Phys. Soc.*, 1998, **43**, 1914.

D.J. Den Hartog *et al.*, "Reducing and Measuring Fluctuations in the MST RFP: A Five-Fold Enhancement of Energy Confinement and Measurement of the MHD Dynamo," Fusion Energy 1996 (*Proc. 16th Int. Conf Montreal 1996*), International Atomic Energy Agency, Vienna (1997).

#### **SELECTED INVITED AND CONTRIBUTED TALKS:**

**P. W. Fontana**, "Einstein and Peace," as part of the World Year of Physics 2005 Public Lecture series, Seattle University (2005).

**P. W. Fontana**, "Turbulence Suppression by Sheared Flow," Reed College colloquium (2004).

**P.W. Fontana**, G. Fiksel, "Local Spectroscopic Ion Flow Measurements," 11th Transport Task Force Workshop, Atlanta, GA (1998).

William Morris Hartmann and **Paul Fontana**, "Azimuthal localization and the asymmetry of the plausibility hypothesis," *J. Acoust. Soc. Am.*, **90**(4), 2266 (1991).

#### **SELECTED CONTRIBUTED PAPERS:**

**PAUL W. FONTANA**, Edward C. Titmus, and Adrian Kirn, "Experiments in the stability of basic two-dimensional flows," *Bull. Amer. Phys. Soc.* 2010, **55**(16)

Edward C. Titmus, Adrian T. Kirn, and **PAUL W. FONTANA**, "Measurement techniques: Viscosity and Surface Drag in Quasi-Two-Dimensional Flows," *Bull. Amer. Phys. Soc.*, 2010, **55**(16)

Edward C. Titmus, Adrian T. Kirn, and **PAUL W. FONTANA**, "Viscosity and surface drag in quasi-two-dimensional flows," *Bull. Amer. Phys. Soc.*, 2010, **55**(2)

**PAUL W. FONTANA**, Edward Titmus, and Adrian Kirn, "Thickness dependence of drag and kinematic viscosity in quasi-two-dimensional flows," *Bull. Amer. Phys. Soc.*, 2009, **54**(19)

**PAUL W. FONTANA** and Edward Titmus, "Distinguishing viscosity and surface friction in quasi-2D flows," *Bull. Amer. Phys. Soc.*, 2008, **53**(15), 106.

Martin Kearney-Fischer, **PAUL FONTANA**, Simon Windell, and Sean Rogers, "Two-dimensional turbulence in sheared flow using circular Couette cell: initial results," *Bull. Amer. Phys. Soc.*, 2007, **52**(1), K1.00224.

**P. W. FONTANA**, M. Kearney-Fischer, S. Rogers, S. Windell, "Measurements of energy spectra in two-dimensional turbulence with sheared mean flow," *Bull. Amer. Phys. Soc.*, 2006, **51**(9), 97.

**P. W. FONTANA**, J. Ulmen, M. Kearney-Fischer, "Experimental study of two-dimensional turbulence in sheared flow: initial results," *Bull. Amer. Phys. Soc.*, 2005, **50**(9), 202.

**P. W. FONTANA**, J. Ulmen, M. Kearney-Fischer, "Experimental study of two-dimensional turbulence in sheared flow," *Bull. Amer. Phys. Soc.*, 2004, **49**(9), 149.

**P.W. FONTANA**, J. Ulmen, "Experimental investigation of sheared flow suppression of turbulence," *Bull. Amer. Phys. Soc.*, 2003, **48**(10), 187.

**P.W. FONTANA**, D.J. Den Hartog, G. Fiksel, S.C. Prager, "Local Velocity Fluctuation Measurements of Dynamo and Transport Studies," *Bull. Amer. Phys. Soc.*, 1998, **43**, p. 1713.

B.E. Chapman *et al.*, "The effects of small dynamo events and their suppression on enhanced confinement discharges in the MST RFP," *Bull. Amer. Phys. Soc.*, 1998, **43**, p.1713.

- P.W. Fontana**, J.C. Chapman, V. Dhyani, G. Fiksel, S.C. Prager, M.R. Stoneking, "Energy Balance during a Sawtooth in MST," *Bull. Amer. Phys. Soc.*, 1997, **42**, p. 2046.
- G. Fiksel, D.J. Den Hartog, **P.W. Fontana**, "Optical Probe for Local Measurements of Plasma Velocity", *Bull. Amer. Phys. Soc.*, 1997, **42**, p. 2045.
- P.W. Fontana**, G. Fiksel, S.C. Prager, "Ion Distribution Function Measurements in MST", *Bull. Amer. Phys. Soc.*, 1996, **41**, p. 1409.
- J.C. Sprott *et al.*, "The Wonders of Physics Outreach Program," *Bull. Amer. Phys. Soc.*, 1996, **41**, p. 1456.
- P.W. Fontana**, D.J. Den Hartog, G. Fiksel, B. Chapman J. Chapman, "Comparison of Impurity and Majority Species Ion Temperature Measurements in the Madison Symmetric Torus (MST)," *Bull. Amer. Phys. Soc.*, 1995, **40**, p. 1755.

### **GRANTS:**

- National Science Foundation Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Grant, "The Boscovich Physics Scholars Program at Seattle University," \$581,800, with co-PI David Boness, July 1, 2011 – June 30, 2016.
- National Science Foundation Grant CBET-0854509, "RUI: Instability and turbulence experiments in two-dimensional flows," \$148,087, September 1, 2009 – August 31, 2012.
- Sabbatical leave, 2008-09.
- College of Science and Engineering summer student stipend award, Summer 2008.
- Seattle University Summer Faculty Fellowship, Summer 2007.
- National Science Foundation Major Research Instrumentation Grant CTS-0421561, \$229,800, July 2004.
- M. J. Murdock Charitable Trust Research Initiation Grant (co-recipient with Ryan McLaughlin and Jennifer Loertscher, Chemistry Department, Seattle University), \$36,000 of \$131,000 total, July 2004—August 2007.
- Research Corporation Cottrell College Science Award #6173, \$45,124, May 2004—June 2006.
- Seattle University Summer Faculty Fellowship, Summer 2004.
- Seattle University Office of Mission and Ministry Endowed Fund Award, Fall 2003 (funds for travel to a national Student Pugwash conference to help initiate the club).
- School of Science and Engineering Faculty Innovation Fellowship, Summer 2003.

### **RESEARCH EXPERIENCE:**

- Conducted Fluid Dynamics Research. Currently conducting experiments in the Seattle University Fluid Turbulence Laboratory. Designed and built equipment and diagnostics to study instability and turbulence in two-dimensional sheared flow. Diagnostics include particle image velocimetry (PIV), laser Doppler velocimetry (LDV), and a novel reflection interference pachymetry (RIP) system. Research involves student collaboration at every level. (Seattle University, Seattle, Washington, ongoing.)
- Established a two-dimensional fluid turbulence laboratory. Designed and built a gravity-driven soap film channel to study fluid flows and turbulent dynamics. Developed and implemented a particle imaging velocimetry (PIV) diagnostic system and corresponding analysis software. Research involved student collaboration. (Lawrence University, Appleton, Wisconsin, 2001-2002.)
- Collaborated on an electron plasma confinement experiment. Helped to upgrade a

unique toroidal electron plasma magnetic confinement device. Implemented a multi-point Langmuir probe for plasma density and potential diagnostics. Supervised two undergraduate student collaborators. (Lawrence University, Appleton, Wisconsin, 2000-2002.)

- Studied ion dynamics in a fusion-grade plasma. Studied ion flows, dynamo activity, and particle transport in the plasma edge, implementing novel spectroscopic diagnostics. Studied "anomalous" heating of ions in the plasma core using spectroscopic and ion energy analysis diagnostics as well as numerical modeling. (University of Wisconsin – Madison, Madison, Wisconsin, 1993-1999.)
- Assisted in psychoacoustics research. Built electronics and hardware for a speaker array designed to study the relative significance of various sensory cues in human localization of a sound source. Participated as a subject in this and other psychoacoustics experiments. (Michigan State University, East Lansing, Michigan, 1990-1991.)

### **UNIVERSITY SERVICE:**

- Seattle University Mission Day Planning Committee and Panelist, 2011.
- Science and Engineering Fellowships Review Committee, 2010.
- Creator and director of SU PhysFest recruitment workshop for high school seniors, 2009–present.
- College of Science and Engineering representative to Academic Assembly, 2009–present.
- Physics Department Search Committee, 2008-09 (while on sabbatical)
- Club Connections Student Recognition Awards selection committee member, May 2008
- Panelist, New Faculty Institute, "Focus on scholarship: Balancing research with your other commitments," 2008.
- Advisor, Alpha Sigma Nu, 2008-present.
- Core Team, College of Science and Engineering \$400,000 grant application to M. J. Murdock Charitable Trust, 2008.
- Core Advancement Preparation Exam volunteer, 2008.
- College of Science and Engineering Dean Search Committee, 2006-07.
- Contributed to successful College of Science and Engineering \$400,000 grant application to Sherman Fairchild Foundation, 2005-06.
- Contributed to College of Science and Engineering application to join M. J. Murdock Charitable Trust regional consortium, 2006.
- Physics department program self-assessment, 2005-06.
- College of Science and Engineering Faculty Development Committee, 2004-07.
- Catholic Studies Minor Task Force, 2004-05.
- Founder and advisor, Seattle University chapter of Student Pugwash, U.S.A., 2003-present.
- University chapel choir member and accompanist, 2003-2007.
- Physics department faculty search, 2003-04.
- College of Science and Engineering Student Summer Seminar Series coordinator, 2003.
- Physics department curriculum revision, 2002–present.
- Advisor, Society of Physics Students, 2002–present.

### **OUTREACH:**

Exhibitor, with J.K. Anderson and J.C. Sprott, 1998 Plasma Sciences Expo, New Orleans,

LA (1998)

Exhibitor, with E. Fernandez and J.C. Sprott, American Physical Society – Division of Plasma Physics Fusion Science Expo, Pittsburgh, PA (1997).

Exhibitor, with K.A. Mirus and J.C. Sprott, American Physical Society – Division of Plasma Physics Open House, Denver, CO (1996).

**ACADEMIC SOCIETIES AND HONORS:**

- Alpha Sigma Nu, honorary membership.
- Granted tenure, September 2008.
- American Association of Physics Teachers
- American Physical Society – Division of Fluid Dynamics, Forum on Physics and Society, Forum on Education
- Phi Beta Kappa
- Phi Kappa Phi
- Sigma Pi Sigma (national honor society of the Society of Physics Students)
- Tower Guard (the service-oriented honor society of Michigan State University)
- Alumni Distinguished Scholarship (four-year merit-based full scholarship awarded to ten incoming Michigan State University students each year)
- National Merit Scholar
- National Honor Society