

Mark D. Nornberg

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Education

- Ph.D. Physics *University of Wisconsin–Madison* (June 2006)
- B.A. Physics and Mathematics *Lawrence University, Appleton, Wisconsin* (June 1998 *cum laude*)

Research and Teaching Experience

Staff Research Physicist, *Princeton Plasma Physics Laboratory* (April 2009–present)

Associate Research Physicist (September 2006–March 2009)

Supervisor: Hantao Ji, Plasma Science and Technology Department

- Initiated operations on a liquid metal Taylor-Couette experiment to observe the Magnetorotational Instability (MRI), a mechanism used to explain fast accretion in astrophysical disks around black holes and neutron stars, and to explore magnetoturbulence in a rotating system.
- Developed a free-surface liquid metal channel flow experiment to study magnetohydrodynamic effects on surface wave stability in a strong magnetic field. The motivation for this experiment is to understand shear-driven instabilities on the surface of neutron stars responsible for strong X-ray bursts and classical novae and to explore the liquid metal diverter concept for a fusion reactor.
- Contributed to the development of an MRI experiment in a Helicon plasma.
- Assisted in mentoring National Undergraduate Fusion Fellowship (NUF) students, Summer Undergraduate Laboratory Internship (SULI) students, and high school interns in summer research projects at PPPL.

Consultant, *Nornberg Scientific Consulting LLC* (March 2009–present)

Development of an MHD muzzle round detector with *Phoenix Technologies*.

Research Assistant, *University of Wisconsin–Madison* (January 1999–August 2007)

Thesis adviser: Professor Cary Forest

- Ph.D. thesis: *The Role of MHD Turbulence in Magnetic Self-Excitation: A Study of the Madison Dynamo Experiment*
- Contributed to construction of a liquid sodium handling facility and experiment featured in *Physics Today*, Feb. 2006, designed and built Hall-effect probe array, and wrote a library of IDL routines for data acquisition, storage, and analysis to study magnetoturbulence.

Teaching Assistant, *University of Wisconsin–Madison*, (September–December 1998)

Professor Michael Winokur

- Lectured, consulted students, graded homework assignments and exams, and led computer-aided laboratory experiments for Introductory Physics.

Research Assistant, University of Wisconsin–Madison (June–August 1998)

Professor Cary Forest

- Assisted in the design of a Bernstein wave phased-array antenna on the Madison Symmetric Torus fusion-plasma experiment by optimizing the gain profile of the waveguide array.

Research Assistant, Lawrence University (January–March 1998)

Professor Matthew Stoneking

- Wrote FORTRAN and IDL code to model the stabilization of a toroidal non-neutral plasma with an electric field (Capstone Project).

Research Assistant, Lawrence University (June–September 1997)

Professor John Brandenberger

- Built an experiment to study optical pumping of Rb atoms through saturated absorption laser spectroscopy (Capstone Project).

Research Publications**Peer Reviewed Journal Articles**

- M. D. Nornberg, H. Ji, E. Schartman, A. Roach, and J. Goodman, “Observation of magnetocoriolis waves in a liquid metal Taylor-Couette experiment,” to be submitted to *Phys. Rev. Lett.* (2009).
- M. D. Nornberg, H. Ji, J. L. Peterson, and J. R. Rhoads, “A liquid metal flume for free surface magnetohydrodynamic experiments,” *Rev. Sci. Instr.* **79**, 094501 (2008).
- N. B. Morley, L. C. Cadwallader, and M. D. Nornberg, “GaInSn usage in the research laboratory,” *Rev. Sci. Instr.* **79**, 056107 (2008).
- E. J. Spence, M. D. Nornberg, R. A. Bayliss, R. D. Kendrick, and C. B. Forest, “Fluctuation-driven magnetic fields in the Madison Dynamo Experiment,” *Phys. Plasmas* **15**, 055910 (2008).
- E. J. Spence, M. D. Nornberg, C. M. Jacobson, C. A. Parada, R. D. Kendrick, N. Z. Taylor, and C. B. Forest, “Turbulent diamagnetism in flowing liquid sodium,” *Phys. Rev. Lett.* **98**, 164503 (2007).
- R. A. Bayliss, M. D. Nornberg, P. W. Terry, and C. B. Forest, “Numerical simulations of current generation and dynamo excitation in a mechanically-forced, turbulent flow,” *Phys. Rev. E* **75**, 026303 (2007).
- M. D. Nornberg, E. J. Spence, R. D. Kendrick, C. M. Jacobson, and C. B. Forest, “Intermittent magnetic field excitation by a turbulent flow of liquid sodium,” *Phys. Rev. Lett.* **97**, 044503 (2006).
- M. D. Nornberg, E. J. Spence, R. A. Bayliss, R. D. Kendrick, C. M. Jacobson, and C. B. Forest, “Measurements of the Magnetic Field Induced by a Turbulent Flow of Liquid Metal,” *Phys. Plasmas* **13**, 055901 (2006).
- E. J. Spence, C. B. Forest, R. D. Kendrick, C. M. Jacobson, and M. D. Nornberg, “Observation of a Turbulence-Induced Large Scale Magnetic Field,” *Phys. Rev. Lett.* **96**, 055002 (2006).

Technical Reports and Conference Proceedings

- Dick Majeski, Jean Paul Allain, Hantao Ji, Neil Morley, Mark Nornberg, and David Ruzic, “Liquid Metal Plasma-Facing Components”, USBPO ReNeW Whitepaper, February 19, 2009.
- M. D. Nornberg, H. Ji, J. L. Peterson, and J. R. Rhoads, “A liquid metal flume for free surface magnetohydrodynamic experiments,” PPPL-4345 August 2008.
- C. B. Forest, R. A. Bayliss, R. D. Kendrick, M. D. Nornberg, R. O’Connell, and E. J. Spence, “Hydrodynamic and numerical modeling of a spherical homogeneous dynamo experiment,” *Magnetohydrodynamics* **38** (2002), no. 1/2, 107–120.
- R. O’Connell, R. Kendrick, M. Nornberg, E. Spence, A. Bayliss, and C. Forest, “On the possibility of an homogeneous MHD dynamo in the laboratory,” *Dynamo and Dynamics, a Mathematical Challenge* (Kluwer Academic Publishers), vol. 26 of *NATO Science Series II, Mathematics, Physics and Chemistry*, 59–63.

Invited Talks

- M. D. Nornberg, “The Princeton Magnetorotational Instability Experiment,” IPELS Workshop, Djurönäset, 8-12 June 2009.
- M. D. Nornberg, “An update of results from the Princeton MRI Experiment ,” CMSO General Meeting, Santa Fe, NM, April 6, 2009.
- M. D. Nornberg, “A review of experiments on angular momentum transport,” Young CMSO Meeting on Momentum Transport, Santa Fe, NM, April 5, 2009.
- M. D. Nornberg, “First MHD Results of the Princeton MRI Experiment,” presented at the APS Division of Plasma Physics meeting (2008), Dallas, TX.

Seminars

- M. D. Nornberg, “Observation of magnetocoriolis waves in the Princeton MRI Experiment,” Plasma Physics Seminar, University of Wisconsin-Madison, January 2009.
- M. D. Nornberg, “Observation of magnetocoriolis waves in the Princeton MRI Experiment,” Plasma Science and Technology Seminar, Princeton Plasma Physics Laboratory, December 2008.
- M. .D. Nornberg, “The Magnetic Ekman effect in magnetized Taylor-Couette flow,” Earth and Planetary Magnetism Group, Institute of Geophysics at ETH Zürich, November 1, 2007.
- M. D. Nornberg, “Induction Mechanisms in the Madison Dynamo Experiment,” P-23 Technical Seminar, Los Alamos National Laboratory, May 2006.
- M. D. Nornberg, “Induction Mechanisms in the Madison Dynamo Experiment,” Plasma Science and Technology Seminar, Princeton Plasma Physics Laboratory, May 2006.
- M. D. Nornberg, “Geomagnetism and Laboratory Dynamos” Wisconsin Geological Society, April 2006, West Allis, Wisconsin.
- M. D. Nornberg, “Laboratory Dynamos: Exploring How Planets Generate Magnetic Fields,” Lawrence University Physics Colloquium, October 2005, Appleton, Wisconsin.

Contributed Talks and Posters

- M. D. Nornberg, “Free-surface MHD channel flow experiments,” presented at the APS Division of Plasma Physics meeting (2008), Dallas, TX.
- M.D. Nornberg, E. Schartman, H. Ji, A. Roach, W. Liu, J. Goodman, “Observation of MHD Instability in the Princeton MRI Experiment,” presented at the Center for Magnetic Self-Organization General Meeting, July 9, 2008.
- M.D. Nornberg, E. Schartman, H. Ji, M.J. Burin, A. Roach, W. Liu, J. Goodman, “Preliminary MHD Results from the MRI Experiment,” presented at the Astrophysics Workshop on “Saturation and Transport Properties of MRI-driven Turbulence,” Institute for Advanced Study, School of Natural Sciences, June 16–18, 2008.
- M.D. Nornberg, H. Ji, L. Peterson, J.R. Rhoads, N. Morely, “Update of Free-surface Liquid Metal Flow Experiments,” presented at the Plasma Facing Components E-meeting, February 13, 2008.
- M.D. Nornberg, E. Schartman, H. Ji, M. Burin, W. Liu, J. Goodman, “Initial results from the Princeton Magnetorotational Instability Experiment using liquid metal,” presented at the annual APS Division of Plasma Physics meeting (2007), Orlando, Florida.
- M.D. Nornberg, E. Schartman, H. Ji, M.J. Burin, W. Liu, J. Goodman, “A liquid metal Taylor-Couette experiment to study the Magnetorotational Instability,” presented at the 15th International Couette-Taylor Workshop, Le Havre, France, July 11, 2007.
- M.D. Nornberg, H. Ji, M.J. Burin, L. Peterson, N. Morely, “Laboratory Study of MHD Effects on Stability and Turbulence in a Free-surface Liquid Metal,” presented at the 2007 Plasma Facing Components meeting, Argonne National Lab, June 6, 2007.
- M.D. Nornberg, E.J. Spence, C.M. Jacobson, C.A. Parada, R.D. Kendrick, C.B. Forest, “Intermittent Magnetic Field Excitation in the Madison Dynamo Experiment,” presented at the annual APS Division of Plasma Physics meeting (2006), Philadelphia, Pennsylvania.
- M. Nornberg, C. Forest, E. Spence, A. Bayliss, R. Kendrick, “The Role of Turbulence in the Madison Dynamo Experiment,” presented at Center for Magnetic Self-Organization General Meeting, August 4, 2006.
- M.D. Nornberg (Speaker), Cary Forest, Roch Kendrick, Erik Spence, Adam Bayliss, Craig Jacobson, Carlos Parada, “MHD Turbulence in the Madison Dynamo Experiment,” presented at the annual APS April meeting (2006), Dallas, Texas.
- M.D. Nornberg, R.A. Bayliss, C.B. Forest, C.M. Jacobson, R.D. Kendrick, E.J. Spence, “MHD Turbulence in the Madison Dynamo Experiment,” presented at the annual APS Division of Plasma Physics meeting (2005), Denver, Colorado.
- M.D. Nornberg (Speaker), E.J. Spence, R.A. Bayliss, C.B. Forest, “Magnetic Response Analysis of the Madison Dynamo Experiment,” presented at Perm Dynamo Days Workshop (2005), Perm, Russia.
- M.D. Nornberg, C.B. Forest, Roch Kendrick, R. O’Connell, E.J. Spence, “Magnetic Eigenmode Analysis of the Madison Dynamo Experiment,” presented at the annual APS Division of Plasma Physics meeting (2004), Savannah, Georgia.
- M.D. Nornberg, C.B. Forest, R. O’Connell, R.D. Kendrick, E.J. Spence, R.A. Bayliss, “Hydrodynamic Experiments Simulating the Madison Dynamo Experiment,” presented at the annual APS Division of Plasma Physics meeting (2000), Québec City, Canada.

Professional Affiliations

- Member of the American Physical Society
- Contributor to the Center for Magnetic Self-Organization in Laboratory and Astrophysical Plasmas
- Member of the U.S. Burning Plasma Organization

Academic Awards

- Van Vleck Fellowship, University of Wisconsin–Madison (1998–99).
- IDEA Fellowship, Lawrence University (1996–97).
- Lambda Sigma Honor Society (1995–96).
- Kimberly-Clark Scholarship, Lawrence University (1994–98).

Service Activities

- Reviewer for *Phys. Rev. Lett.*, *The New Journal of Physics*, and *Nucl. Fusion* (2007-2008).
- Organized the PPPL Plasma Science and Technology Seminar Series (2006-07).
- Consultant for Anne Schoenemann, Instructional Resource Teacher in Madison School District Professional Development Workshop on 3rd Grade Science: Physics of Sound (2005).
- Participated in Motorola Midwest Regional FIRST robotics competition with team of Appleton North High School students (Palatine, Illinois 1997).
- Assisted in Lawrence University Laser Physics Workshop (1995–97).

References

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