

# MAARTEN A. RUTGERS

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## RESEARCH INTERESTS:

Soft Condensed Matter Experiments  
Colloidal Self Assembly  
Colloidal Interactions

Two Dimensional Fluids Experiments  
Granular Materials  
Particle Laden Flows

## EDUCATION:

1989-1994 **Princeton University**

M.A., Physics, June 1991.

Ph.D., Physics, May 1995.

Thesis: "Experiments with Hard, Soft, and Hydrodynamically Interacting Spheres."

Thesis Advisor: Prof. Paul M. Chaikin.

1985-1989 **University of Minnesota, Minneapolis**

B.S., Physics, Summa Cum Laude, June 1989.

## PROFESSIONAL EXPERIENCE:

1997-Present **The Ohio State University, Department of Physics**

Assistant Professor

1996-1997 **The Ohio State University**

Postdoctoral Fellow.

Continued 2D turbulence and thin film rheology research.

1994-1996 **University of Pittsburgh**

Postdoctoral Fellow.

2D hydrodynamics and thin film flow research.

1989-1994 **Princeton University / Exxon Research and Engineering**

Graduate Research Assistant.

Soft condensed matter research on colloidal crystals, colloidal sedimentation, and hydrodynamic instabilities of fluidized beds.

1986-1989 **University of Minnesota, Minneapolis**

Undergraduate Research Assistant.

Condensed matter physics research on sub Kelvin heat capacity measurements, and magnetic garnet crystals.

## RESEARCH FUNDING:

- 1997-1999 **Ohio State University Seed Grant**  
\$17,214, "Fluid dynamics experiments in two dimensions: Investigating the fluid properties of flowing soap films." Principal Investigator: Maarten Rutgers, 100% responsibility.
- 1998-2000 **American Chemical Society Petroleum Research Fund**  
\$25,000, "Flowing soap films: Exploring new frontiers in surface rheology." Principal Investigator: Maarten Rutgers, 100% responsibility.
- 1999-2003 **National Science Foundation CAREER Award**  
\$360,000, "Colloidal sedimentation and colloidal clusters: Exploring new ways of making microstructured materials with novel optical properties." Principal Investigator: Maarten Rutgers, 100% responsibility.

## HONORS AND AWARDS:

- Recipient, National Science Foundation CAREER award, Formerly National Presidential Investigator / National Young Investigator award (See research funding list), 1999.
- The Ohio State University Office of Disability Services Teaching Award, 1999.
- Joint Finalist of the APS Division of Fluid Dynamics Meeting Gallery of Fluid Motion, (See submitted conference presentation list) 1995.
- Fellowship to attend the NATO ASI summer school "Mobile Particulate Systems," Cargèse, France, 1994.
- Joseph Henry Prize for Princeton First Year Physics Graduate Students, 1989.

## PROFESSIONAL ACTIVITIES AND AFFILIATIONS:

- Member American Physical Society, Divisions of Condensed matter physics and Fluid dynamics.
- Consultant and exhibit organizer, American Physical Society Centennial Meeting.
- Reviewer: Physical Review E, Physical Review Letters, Physics of Fluids, Nature.

## TEACHING EXPERIENCE:

1997-present **The Ohio State University**  
Physics 131, 132 recitations (Introductory physics with calculus). Physics 103,104 (World of Energy, physics for non-majors). Physics 132 lecture (Introductory E+M).

1997-Present **Undergraduate research**

I always employ at least one local undergraduate student in my laboratory, encouraging them to write a senior thesis and graduate with honors. Undergraduates will be included as authors of scientific publications. I have participated for three years running in the Ohio State University NSF-REU program.

1996 **Web page award.**

The San Diego Union Tribune awarded a subsection of my world wide web page on soap films for it's appeal to young students of science.

1995-Present **Promotion of Soap Film Science Museum Exhibits.**

My newly developed flowing soap film apparatus shows great promise as an educational tool. Completion of a museum exhibit of my design is slated for 1997 at the Carnegie Science Center of Pittsburgh. The Xperiment science museum in Sweden has already completed an exhibit after my design. Preliminary Demonstrations led to a number of interviews, one of which aired on CNN, educating the general public on the importance of fluid dynamics.

1995 **Pennsylvania Junior Academy of Science Workshop Series**

I participated in several weekend workshops sponsored by the Pennsylvania Junior Academy of Science to promote awareness of academic research.

1993-1994 **Science Fair Design, Trenton, NJ.**

As part of a team of Princeton faculty and graduate students I designed, built, and helped coordinate several physics demonstrations for the first and second Trenton Science Fairs. The events raised funds for the construction of a new science museum.

1990-1991 **Princeton University**

Teaching Assistant.

Department of Physics, sophomore physics laboratory course.

Duties included lectures, supervision of experiments, and grading of reports.

PAPERS IN PROGRESS

1. M. A. Rutgers, and W.B. Daniel, *Flowing film rheology*, in preparation.
2. W. B. Daniel and M. A. Rutgers, *Intermittency in 2D turbulence*, in preparation.

## INVITED REVIEW ARTICLES:

1. M. A. Rutgers, *Flowing Soap Films: A Platform for 2D Non-linear Dynamics Experiments*, Nonlinear Science Today (refereed), PII: S09389008 (99) 00001-1, [www.springer-ny.com/nst/](http://www.springer-ny.com/nst/), march 1999.

## PUBLICATIONS IN REFEREED JOURNALS:

1. M. A. Rutgers, X. L. Wu, and W. B. Daniel, *Conducting fluid dynamics experiments with vertically falling soap films*, Rev. Sci. Ins. **72**:3025-3037 (2001)
2. X. L. Wu, R. Levine, M. A. Rutgers, H. Kellay, W.I. Goldburg, *Infrared technique for measuring thickness of a flowing soap film*, **72**:2467-2471 (2001).
3. D. A. Seeber, J. H. Hoftiezer, W. B. Daniel, M. A. Rutgers, and C. H. Pennington, *Tri-axial magnetic field gradient system for microcoil magnetic resonance imaging.*, Rev. Sci. Ins. **71**:4263-4272 (2000).
4. A. Belmonte, W. I. Goldburg, H. Kellay, M. A. Rutgers, B. Martin, and X. L. Wu, *Velocity fluctuations in a turbulent soap film: The third moment in two dimensions*, Phys. Fluids **11**:1196-1200 (1999).
5. M. A. Rutgers, *Forced 2D Turbulence: experimental evidence of simultaneous inverse energy and forward energy cascades*, Phys. Rev. Lett. **81**:2244-2247 (1998).
6. B.K. Martin, X.L. Wu, W.I. Goldburg, and M.A. Rutgers, *Spectra of Decaying Turbulence in a soap film*, Phys. Rev. Lett. **80**:3964-3967 (1998).
7. W. I. Goldburg, M. A. Rutgers, and X-l. Wu *Experiments on Turbulence in Soap Films*, , *PhysicaA***239**:340-349, (1997).
8. M. A. Rutgers, X-l. Wu, A. A. Petersen, R. Baghavatula, and W. I. Goldburg *Two Dimensional Velocity Profiles and Laminar Boundary Layers in Flowing Soap Films*, , *Phys. Fluids*, **8**:2847-2854, (1996).
9. M. A. Rutgers, J. H. Dunsmuir, J.-Z. Xue, W. B. Russel, and P. M. Chaikin, *Measurement of the Hard-Sphere Equation of State Using Screened Charged Polystyrene Colloids*, *Phys. Rev. B*, **53**: 5043-5046, (1996).
10. M.A. Rutgers, J.Z. Xue, E. Herbolzheimer, W.B. Russel, and P.M. Chaikin, *Crystalline Fluidized Beds*, *Phys. Rev. E*, **51**: 4674-4678, (1995).
11. J.Z. Xue, E. Herbolzheimer, M.A. Rutgers, W.B. Russel, and P.M. Chaikin, *Diffusion, Dispersion, and Settling of Hard Spheres*, *Phys. Rev. Lett.*, **69**: 1715-1718, (1992).
12. M.A. Rutgers, D. Dummer, J. Cleveland, W. Weymann, E.D. Dahlberg, and D. Hinks, *Magnetization and Heat Capacity Studies of Single Crystals of  $ErRhB_4$* , *J. Physique*, **49(c8)**: 407-408, (1988).

#### COVERAGE OF RESEARCH IN THE POPULAR PRESS:

1. G. Solomons Jr., *Meredith Monk: A Voice in Motion*, Dance Magazine, Vol 65., No. 7, pp. 46–49,70, July 2001.
2. S. Carlson, *Fun with Flat Fluids*, Scientific American, **282**(5):106-107, May 2000.
3. M. Buchanan, *Into the vortex*, New Scientist, **163**(2198):26-30, August 7, 1999.
4. R. Irion, *Fluid dynamics: soap films reveal whirling worlds of turbulence*, Science **284**:1609, 1999.
5. A.P. Gast and W.B. Russel, *Simple Ordering in Complex Fluids*, Physics Today, p26, December 1998.
6. P. Tabeling, *Tackling turbulence in two dimensions*, Physics World, **11**:23, December 1998.
7. B. Brewster, *Soap Bubble Science*, abcnews.com, October 28, 1998.
8. M. A. Rutgers, X-l. Wu, and W. I. Goldberg, *The Onset of 2-D Grid Generated Turbulence in Flowing Soap Films*, Winning poster entry: American Physical Society Division of Fluid Dynamics Meeting, November 1995, Irvine, CA. *Phys. Fluids*, **8**:s7, Sept. 1996.
9. D. Wilson, *Soap film studied for clues to plane crashes*, CNN Science and Technology Week, August 26, 1996.
10. B. Spice, *Grasping science is slippery, but museum's soapy display helps*, Pittsburgh Post Gazette, April 26, p B1, 1996.

#### TEXTBOOK CONTRIBUTIONS:

1. Photo contribution in *Physics: The nature of things*, S. Lea and J. Burke, Brooks Cole Publ. Co., 1996.
2. Video contributions in *Multi-Media Fluid Mechanics*, G.M. Homsy *et al.*, Cambridge University Press, Cambridge, 2000.

#### INVITED CONFERENCE PRESENTATIONS:

1. *Flowing soap films: a novel platform for 2D turbulence experiments*, Joint U.S.-European [Plasma Fusion] Transport Task Force Workshop, April 1999, Portland, OR.
2. *2D Laminar and Turbulent flows in soap films*, American Physical Society Centennial Meeting, March 1999, Atlanta, GA. *Bull. Am. Phys. Soc.* Vol. 44, No. 1, Part 2, Pg. 1141 (1999).
3. *DCMP Display talk: New Physics with Soap Bubbles*, American Physical Society Centennial Meeting, March 1999, Atlanta, GA.
4. M.A. Rutgers and others, *Springtime Demonstrations in Ohio*, American Physical Society April Meeting, *Bull. Am. Phys. Soc.* Vol. 43, No. 2, 1141 (1998).

5. Fluid Dynamics of Giant Soap Films, Educator Day, American Physical Society April Meeting, April 1998, Columbus, OH.

CONTRIBUTED CONFERENCE PRESENTATIONS:

1. D.S. Stoker and M.A. Rutgers, *Yield stress transition in gas fluidized sand*, American Physical Society Division of Fluid Dynamics Meeting, Session AH.005, Washington DC, Nov. 2000.
2. W.B. Daniel and M.A. Rutgers, *The effect of air drag on freely decaying turbulence in a soap film*, American Physical Society Division of Fluid Dynamics Meeting, Session MB.005, Washington DC, Nov. 2000.
3. D.S. Stoker and M.A. Rutgers, *Gas Fluidized Sand, liquid or solid?*, American Physical Society March Meeting, Bull. Am. Phys. Soc. Vol. 45, No. 1, Pg. 499 (2000).
4. W.B. Daniel and M.A. Rutgers, *A measurement of intermittency in the enstrophy and energy cascades of forced 2D turbulence.*, American Physical Society Division of Fluid Dynamics Meeting, Bull. Am. Phys. Soc. Vol. 44, No. 8, Pg. 16 (1999).
5. K.K. Knappman and M.A. Rutgers, *Drag measurements of spheres in gas fluidized sand*, American Physical Society Division of Fluid Dynamics Meeting, Bull. Am. Phys. Soc. Vol. 44, No. 8, Pg. 176 (1999).
6. M. Bell and M.A. Rutgers, *The dynamics of a steady Taylor cone electrospray*, American Physical Society Division of Fluid Dynamics Meeting, Bull. Am. Phys. Soc. Vol. 43, No. 9, Pg. 2111 (1998).
7. M.A. Rutgers, *Experimental observation of the inverse energy and forward enstrophy cascades in 2D turbulence*, American Physical Society Division of Fluid Dynamics Meeting, Bull. Am. Phys. Soc. Vol. 43, No. 9, Pg. 1987 (1998).
8. M.A. Rutgers and S. Bradley, *Steady State 2D Forced Turbulence Experiments*, American Physical Society Division of Fluid Dynamics Meeting, Bull. Am. Phys. Soc. Vol. 42, No. 11, Pg. 2116 (1997).
9. M.A. Rutgers, X.L. Wu, and W.I. Goldburg, *On the viscosity of soap films.*, American Physical Society Meeting, Bull. Am. Phys. Soc. Vol. 42, No. 1, Pg. 773 (1997).
10. M.A. Rutgers, X.L. Wu, and W.I. Goldburg, *Flowing Soap Films in a Vacuum*, American Physical Society Division of Fluid Dynamics Meeting, Bull. Am. Phys. Soc. Vol. 41, No. 9, Pg. 1772 (1996).
11. M.A. Rutgers, X.L. Wu, and W.I. Goldburg, *The Onset Of 2-D Grid Generated Turbulence in Flowing Soap Films*, Winning Poster Entry, American Physical Society Fluid Dynamics Meeting, November, 1999, Irvine, CA. *Phys. Fluids* 8:s7, Sept. 1996.
12. M.A. Rutgers, X-l. Wu, and W.I. Goldburg, *Interaction of von Karman Vortex Streets in a Flowing Soap Film*, Video Submission, American Physical Society Division of Fluid Dynamics Meeting, November 1995, Irvine, CA.

13. M.A. Rutgers, X.L. Wu, and W.I. Goldberg, *Flowing Soap Films as 2-D fluids: Recent Advances*, American Physical Society Division of Fluid Dynamics Meeting, *Bull. Am. Phys. Soc.* Vol. 40, No. 12, Pg. 1967 (1995).
14. M.A. Rutgers, W.B. Russel, P.M. Chaikin, and J.H. Dunsmuir, *Real Hard Spheres*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 40, No. 1, Pg. 518 (1995).
15. M.A. Rutgers and P.M. Chaikin, *Velocity Fluctuations and Correlations in creeping Fluidized Beds*, NATO ASI Summer School: "Mobile Particulate Systems," July 1994, Cargèse, France.
16. M.A. Rutgers, P.M. Chaikin, J.Z. Xue, and E. Herbolzheimer *Velocity Correlations in Fluidized Beds*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 39, No. 1, Pg. 317 (1994).
17. M.A. Rutgers, P.M. Chaikin, and J.H. Dunsmuir, *Osmotic Pressure of Hard Spheres*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 39, No. 1, Pg. 288 (1993).
18. W.B. Russel, M.A. Rutgers, and P.M. Chaikin, *Sedimentation Rates for Crystalline and Disordered Colloidal Suspensions*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 38, No. 1, Pg. 343 (1993).
19. M.A. Rutgers, W.B. Russel, and P.M. Chaikin, *The Elastic Properties of Colloidal Sediments in a Fluidized Bed*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 37, No. 3, Pg. 391 (1992).
20. M.L. Gee, M.A. Rutgers, W.B. Russel, and P.M. Chaikin, *Controlling the Density of Colloidal Sediments by Means of a Fluidized Bed*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 36, No. 3, Pg. 298 (1991).
21. M.A. Rutgers, W.B. Russel, and P.M. Chaikin, *Static Shear Moduli of Hard Sphere Sediments*, American Physical Society Meeting, *Bull. Am. Phys. Soc.* Vol. 36, No. 3, Pg. 398 (1991).

#### INVITED SEMINARS:

1. *2D Laminar and Turbulent flows in soap films*, Physics Colloquium, UCLA, November 2000.
2. *Colloidal matter: a path to new hard and soft materials*, Condensed matter physics seminar, UCLA, November, 2000.
3. *Colloids, Crystallization, Sedimentation, and New Materials*, E-ink inc., March, 2000.
4. *2D Laminar and Turbulent flows in soap films*, Physics Colloquium, UC Irvine, January 2000.
5. *2D flow in soap films*, Condensed matter physics seminar, UCLA, January 2000.

6. *2D Laminar and Turbulent flows in soap films*, Applied mathematics seminar, New York University Courant Institute, November 1999.
7. *2D flow in soap films*, Physics Colloquium, Princeton University, November 1999.
8. *2D flow in soap films*, Condensed matter seminar, University of Oslo, Norway, September 1999.
9. *2D flow in soap films*, Research Seminar, Symyx Technologies inc., San Jose, CA, June 1999.
10. *2D Laminar and Turbulent flows in soap films*, Condensed matter seminar, Case Western Reserve University, April 1999.
11. *2D flow in soap films*, Physics Colloquium, Kent State University, April 1999.
12. *Fluids in Flatland*, Physics Colloquium, Ohio Wesleyan University, Delaware, OH, February 1999.
13. *2D fluid dynamics experiments in soap films*, Applied Physics Colloquium, University of Wisconsin, Madison, February 1999.
14. *2D fluid dynamics experiments in soap films*, Plasma Physics Seminar, University of California, San Diego, January 1999.
15. *Colloidal matter: new hard and soft materials*, Center for Materials Research Faculty Seminar, The Ohio State University, October 1998.
16. *2D turbulence and other experiments with flowing soap films.*, Colloquium, Department of Physics, University of Houston, Houston, TX, October 1998.
17. *2-D Fluid dynamics in Soap Films*, Colloquium, Department of Physics, Bowling Green University, Bowling Green, OH, September 1998.
18. *Experiments on 2-D Fluid Dynamics*, Research Seminar, NASA Lewis Research Center, Cleveland, OH, May 1998.
19. *2-D Flows in Soap Films*, Applied Mathematics Seminar, Massachusetts Institute of Technology, Cambridge, MA, April 1998.
20. *Single Cell MRI imaging*, Ohio State Center for Materials Research Center, The Ohio State University, Columbus, OH, March 1998.
21. *Fluid Dynamics with Flowing Soap Films*, Condensed Matter Seminar, Purdue University, West Lafayette, IN, February 1998.
22. *2D Fluid Dynamics Experiments*, Fluid Dynamics Seminar, Dept. of Mechanical Engineering, The Ohio State University, Columbus, OH, January 1998.
23. *Physics in Flatland*, Condensed Matter Seminar, Notre Dame University, South Bend, IN, December 1997.

24. *2D Fluid dynamics Experiments*, Special Seminar, Chemical Engineering Dept., UCSB, Santa Barbara, CA, November 1997.
25. *2-D Fluid Dynamics in Flowing Soap Films*, Physics Colloquium, The Ohio State University, Columbus, OH, October 1997.
26. *2-D Fluid Dynamics Experimental Methods*, Workshop on 2D Fluid Dynamics, Los Alamos National Laboratory, Los Alamos, NM, August 1997.
27. Colloidal Crystals and Photonic Bandgaps, Special Seminar, Lucent Technologies (Bell Labs), Murray Hill, NJ, May 1997.
28. *2-D Fluid Dynamics in Soap Films*, Special Seminar, Department of Physics, University of Rochester, Rochester, NY, April 1997.
29. *Colloidal Liquids, Gases, Solids, and Photonic Band Gaps*, Condensed Matter Seminar, Department of Physics, University of Rochester, Rochester, NY, April 1997.
30. *Colloidal Liquids, Gases, Solids, and Photonic Band Gaps*, Condensed Matter Seminar, Department of Physics, University of Massachusetts, Amherst, MA, March 1997.
31. *Colloidal Liquids, Gases, Solids, and Photonic Band Gaps*, Special Condensed Matter Seminar, Department of Physics, The Ohio State University, Columbus, OH, February 1997.
32. *2-D Fluid Dynamics in Soap Films*, Colloquium, Department of Physics, Miami University, Oxford, OH, January 1997.
33. *2-D Fluid Dynamics in Soap Films*, Student Seminar, Department of Aerospace Engineering, The Ohio State University, Columbus, OH, January 1997.
34. *2-D Fluid Dynamics in Soap Films*, Department of Physics, University of Leeds, Leeds, U.K., November 1996.
35. *2-D Fluid Dynamics in Soap Films*, Department of Aeronautics, Imperial College, London, U.K., November 1996.
36. *How to Build a 2D Wind Tunnel*, Special Condensed Matter Seminar, James Franck Institute, The University of Chicago, November 1996.
37. *2-D Fluid Dynamics in Soap Films*, Colloquium, Dennison College, Granville Ohio, October 1996.
38. *2-D Fluid Dynamics in Soap Films*, Colloquium, Kenyon College, Gambier Ohio, October 1996.
39. *2-D Fluid Dynamics in Soap Films*, Special Condensed Matter Seminar, University of Minnesota, Minneapolis, September 1996.
40. *2-D Fluid Dynamics in Soap Films*, Undergraduate Colloquium, Carnegie Mellon University, Pittsburgh Pennsylvania, September 1996.

41. *2-D Fluid Dynamics in Soap Films*, Weekly Condensed Matter Seminar Series, Carnegie Mellon University, Pittsburgh Pennsylvania, July 1996.
42. *2-D Fluid Dynamics in Soap Films*, Weekly Group Meeting of Dr. V. A. Parsegian, National Institutes of Health, Bethesda Maryland, April 1996.
43. *2-D Fluid Dynamics in Soap Films*, Physics Dept. Colloquium, Oklahoma State University, Stillwater Oklahoma, April 1996.
44. *Turbulent and Laminar Flows in Soap Films*, Weekly Group Meeting, Institute for Non Linear Science, University of California, San Diego, November 1995.
45. *The Hard Sphere Phase Transition: Experimental Observations.*, Weekly Seminar, Institut Non Linéaire de Nice, Université de Nice, Sophia Antipolis, France, August 1995.
46. *Physics with Hard Spheres*, Condensed Matter Seminar Series, Department of Physics and Astronomy, University of Pittsburgh, PA, May 1995.
47. *Physics with Hard Spheres*, Weekly Condensed Matter Lunch Seminar, Physics Department, University of Minnesota, Minneapolis, May 1995.
48. *Physics with Hard Spheres*, Physics Department Seminar, St. Olaf College, Northfield, MN, May 1995.
49. *Equations of State of Colloidal Suspensions*, Condensed Matter Seminar, AT&T Bell Laboratories, Murray Hill, NJ, April 1994.
50. *Sedimentation as Seen by a Physicist*, Chemical Engineering Departmental Seminar Series, Princeton University, October 1993.

PERSONAL:

Birthdate: November 25, 1967

Citizenship: Netherlands

US Permanent Resident