Mark Francis Demers

Curriculum Vitae

Professor of Mathematics
Department of Mathematics
Fairfield University
Fairfield, CT 06824

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Education

Courant Institute, New York University, Ph.D. in Mathematics. 1998-2003
Awarded M.S. in Mathematics, May 2001.

Amherst College, B.A. *Magna Cum Laude* in Mathematics and English. 1990-1994

Research Interests

Statistical properties of dynamical systems; ergodic theory; transfer operators; open systems and escape rates; billiards and related models from mathematical physics.

Academic Appointments

Professor, Department of Mathematics 2017 – present
Fairfield University

Associate Professor, Department of Mathematics 2011 – 2017
Fairfield University, Connecticut.

Assistant Professor, Department of Mathematics and Computer Science 2006 – 2011
Fairfield University, Connecticut.

Visiting Scholar, Courant Institute, New York University January – May 2009

Postdoctoral Fellow, Mathematical Sciences Research Institute January – May 2007
Berkeley, California.

Visiting Assistant Professor, School of Mathematics 2003 – 2006
Georgia Institute of Technology, Georgia.

Grants, Honors, Fellowships

Invited Speaker, International Congress of Mathematics 2022. July 2022

National Science Foundation Research Grant 2021-2024
PI: Award amount $214,088. Proposal title: *RUI: Equilibrium and nonequilibrium dynamics for systems of physical origin.*

National Science Foundation Research Grant 2018-2021
PI: Award amount $245,423. Proposal title: *RUI: Nonuniformly hyperbolic dynamical systems out of equilibrium.*

Visiting Researcher, University of Rome, Tor Vergata, Rome, Italy. May 2019

Wall Award Recipient, Fairfield University. 2016-2017
Research award granting one semester paid leave for focused research.

Research-in-Pairs Grant, Centre International de Rencontres Mathématiques August 2017
Grant providing full local support to conduct focused research for 2 weeks at CIRM, Luminy, France, with two other mathematicians. Grant awarded in September 2015.

Professeur Invité, École Normale Supérieure, Paris, France. April 2016

National Science Foundation Research Grant 2014-2018
PI: Award amount $168,500. Proposal title: *RUI: Statistical properties of nonequilibrium and extended dynamical systems.*

Visiting Professor, University of Toulon and Centre for Theoretical Physics, June – July 2014
University of Aix-Marseille, Luminy Campus, France.

Visiting Researcher, University of Rome, Tor Vergata, Rome, Italy. April 2014

Research in Groups Grant, International Centre for Mathematical Sciences March 2014
Awarded £7,000 to conduct research for 1 month at ICMS in Edinburgh, Scotland, with a group of 3 other mathematicians.

Visiting Fellow, Research Semester in Mathematics for the Fluid Earth November 2013
Isaac Newton Institute, Cambridge University, UK.

National Science Foundation Research Grant 2011 – 2014
PI: Award amount $130,000. Proposal title: *RUI: Open, coupled and extended dynamical systems with nonuniform hyperbolicity.*

Visiting Professor, Semester in "Hyperbolic dynamics, large deviations May – June 2013
and fluctuations," Centre Interfacultaire Bernoulli, EPFL, Lausanne, Switzerland.

National Science Foundation Research Grant 2008 – 2011
PI: Award amount $108,086. Proposal title: *Topics in Dynamical Systems: Open systems, coupled systems and discretization.*

London Mathematical Society Research Grant May – June 2011
Awarded Scheme 2 grant of £2,000 to visit 3 universities in the UK to foster potential collaborations.

Faculty Research Award, Fairfield University Spring 2010

Science Institute Grant, Fairfield University 2009
Co-wrote grant to sponsor a general audience mathematics lecture at Fairfield.

Visiting Researcher, Semester in Hyperbolic Dynamics May - June 2008
Erwin Schrödinger Institute for Mathematical Physics, Vienna, Austria.

Visiting Researcher, Centro Ennio de Giorgi, May - July 2006
Collegio Puteano, Scuola Normale Superiore, Pisa, Italy.

Visiting Researcher, Trimester "Time at Work," May - June 2005
Institut Henri Poincaré, Paris, France.

Research Grant, University of Rome, Tor Vergata, Rome, Italy. June 2004

Submitted Research Papers (See *http://www.faculty.fairfield.edu/mdemers/research/pub.html*)

1. V. Baladi, J. Carrand and M.F. Demers, *Measure of maximal entropy for finite horizon Sinai billiard flows*, submitted.

2. M.F. Demers and A. Korepanov, *Rates of mixing for the measure of maximal entropy of dispersing billiard maps,* submitted.

Journal Publications (See *http://www.faculty.fairfield.edu/mdemers/research/pub.html*)
All publications are peer-reviewed.

1. M.F. Demers and C. Liverani, *Projective cones for sequential dispersing billiards,* Comm. Math. Phys. **401**:1 (2023), 841-923.

2. M.F. Demers, *Topological entropy and pressure for finite horizon Sinai billiards,* to appear in Proceedings of the ICM 2022.

3. V. Baladi and M.F. Demers, *Thermodynamic formalism for dispersing billiards,* Journal of Modern Dynamics **18** (2022), 415-493.

4. M.F. Demers, *Uniqueness and exponential mixing for the measure of maximal entropy for piecewise hyperbolic maps,* Discrete and Contin. Dynam. Sys. *Special issue celebrating 25 years of DCDS,* **41**:1 (2021), 217-256.

5. M.F. Demers and M. Todd, *Asymptotic escape rates and limiting distributions for multimodal maps,* Ergod. Th. And Dynam. Sys. **41**:6 (2021), 1656-1705.

6. M.F. Demers, F. Pène and H.-K. Zhang, *Local limit theorem for randomly deforming billiards,* Comm. Math. Phys. **375** (2020), 2281-2334.

7. M.F. Demers, I. Melbourne and M. Nicol, *Martingale approximations and anisotropic Banach spaces with an application to the time-one map of a Lorentz gas,* Nonlinearity **33**:8 (2020), 4095-4113.

8. V. Baladi and M.F. Demers, *On the measure of maximal entropy for finite horizon Sinai billiard maps,* J. Amer. Math. Soc. **33**:2 (2020), 381-449.

9. M.F. Demers, *A gentle introduction to anisotropic Banach spaces,* Chaos, Solitons and Fractals **116** (2018), 29-42.

10. M.F. Demers, L. Rey-Bellet and H.-K. Zhang, *Fluctuation of the entropy production for the Lorentz gas under small external forces,* Comm. Math. Phys. **363**:2 (2018), 699-740.

11. H. Bruin, M.F. Demers and M. Todd, *Hitting and escaping statistics: mixing, targets and holes,* Advances in Math. **328** (2018), 1263-1298.

12. V. Baladi, M.F. Demers and C. Liverani, *Exponential decay of correlations for finite horizon Sinai billiard flows,* Inventiones Math. **211:**1 (2018), 39-177.

13. M.F. Demers and M. Todd, *Slow and fast escape for open intermittent maps,* Comm. Math. Phys. **351**:2 (2017), 775-835.

14. M.F. Demers, C. Ianzano, P. Mayer, P. Morfe, and E. Yoo, *Limiting distributions for countable state topological Markov chains with holes,* Discrete and Contin. Dynam. Sys. **37**:1 (2017), 105-130.

15. M.F. Demers and M. Todd, *Equilibrium states, pressure and escape for multimodal maps with holes,* Israel Journal of Mathematics **221**:1 (2017), 367-424.

16. M.F. Demers and B. Fernandez, *Escape rates and singular limiting distributions for intermittent maps with holes,* Trans. Amer. Math. Soc. **368**:7 (2016), 4907-4932.

17. M.F. Demers and H.-K. Zhang, *Spectral analysis of hyperbolic systems with singularities,* Nonlinearity **27** (2014), 379-433.

18. M.F. Demers, *Escape rates and physical measures for the infinite horizon Lorentz gas with holes*, Dynamical Systems: An International Journal **28**:3 (2013), 393-422

19. M.F. Demers, *Dispersing billiards with small holes*, in *Ergodic theory, open dynamics and coherent structures*, W. Bahsoun, C. Bose and G. Froyland, eds. Springer Proceedings in Mathematics & Statistics. Springer: New York (2014), 137-170.

20. M.F. Demers and H.-K. Zhang, *A functional analytic approach to perturbations of the Lorentz gas*, Communications in Mathematical Physics **324**:3 (2013), 767-830.

21. M.F. Demers and P. Wright, *Behavior of the escape rate function in hyperbolic dynamical systems*, Nonlinearity **25** (2012), 2133-2150.

22. M.F. Demers and H.-K. Zhang, *Spectral analysis of the transfer operator for the Lorentz gas,* Journal of Modern Dynamics **5**:4 (2011), 665-709.

23. M.F. Demers, P. Wright and L.-S. Young, *Entropy, Lyapunov exponents and escape rates in open systems*, Ergodic Theory and Dynamical Systems **32**:4 (2012), 1270-1301.

24. M.F. Demers, *Functional Norms for Young Towers*, Ergodic Theory and Dynamical Systems **30**:5 (2010), 1371-1398.

25. M.F. Demers, P. Wright and L.-S. Young, *Escape rates and physically relevant measures for billiards with small holes*, Communications in Mathematical Physics **294** (2010), 353-388.

26. H. Bruin, M.F. Demers and I. Melbourne, *Existence and convergence properties of physical measures for certain dynamical systems with holes,* Ergodic Theory and Dynamical Systems **30** (2010), 687-728.

27. M.F. Demers and M.P. Wojtkowski, *A family of pseudo-Anosov maps,* Nonlinearity, **22** (2009), 1743-1760.

28. M.F. Demers and C. Liverani, *Stability of statistical properties in two-dimensional piecewise hyperbolic maps,* Trans. Amer. Math. Soc. **360**:9 (2008), 4777-4814.

29. M.F. Demers and L.-S. Young, *Escape rates and conditionally invariant measures,* Nonlinearity, **19** (2006), 377-397.

30. L.A. Bunimovich and M.F. Demers, *Deterministic models of the simplest chemical reactions,* Journal of Statistical Physics **120** (2005), 239-252.

31. M.F. Demers, *Markov extensions and conditionally invariant measures for certain logistic maps with small holes*, Ergodic Theory and Dynamical Systems **25**:4 (2005), 1139-1171.

32. M.F. Demers, *Markov extensions for dynamical systems with holes: an application to expanding maps of the interval*, Israel Journal of Mathematics **146** (2005), 189-221.

Books

1. M.F. Demers, N. Kiamari and C. Liverani, *Transfer Operators in Hyperbolic Dynamics: An Introduction,* 33º Colóquio Brasiliero de Matemática, IMPA 2021, 252 pp.

Scientific Visits

1. University of Rome, Tor Vergata, Italy, May 2023 (Prof. Liverani)
2. University of Rome, Tor Vergata, Italy, May 2019 (Prof. Liverani)
3. Université de Paris VI, France, May 2018 (Prof. Baladi)
4. Univerity of Rome, Tor Vergata, Italy, March 2017 (Prof. Liverani)
5. Université de Paris VI, France, February 2017 (Prof. Baladi)
6. Erwin Schrödinger Institute for Mathematics and Physics, Vienna, Austria, May 2016 (program on Mixing Flows and Averaging Methods)
7. École Normale Supéreiure, Paris, France, April 2016 (Prof. Baladi)

8. University of Houston, March 2015 (Prof. Zhang)
9. École Normale Supérieure, Paris, France, September 2014 (Prof. Baladi)
10. University of Aix-Marseille, Luminy Campus CPT, France, July 2014 (Prof. Vaienti)
11. University of Rome, Tor Vergata, Italy, April 2014 (Prof. Liverani)
12. University of Copenhagen, Denmark, August 2013 (Prof. Baladi)
13. École Polytechnique Fédérale de Lausanne, Switzerland, May-June 2013 (Program in hyperbolic dynamics, large deviations and fluctuations)
14. University of Vienna, Austria, May 2013, (Prof. Bruin)
15. University of Rome, Tor Vergata, Italy, May 2012 (Prof. Liverani)
16. University of Brest, France, May 2012 (Profs. Penne and Saussol)
17. University of Bristol, England, June 2011 (Prof. Dettman)
18. University of Surrey, England, May 2011 (Prof. Melbourne)
19. Loughborough University, England, May 2011 (Prof. Bahsoun)
20. University of Massachusetts at Amherst, August 2010 (Prof. Zhang)
21. University of Porto, Porto, Portugal, May-June 2009 (Prof. Alves)
22. University of Rome, Tor Vergata, Italy, May 2009 (Prof. Liverani)
23. Erwin Schrödinger Institute for Mathematics and Physics, Vienna, Austria, May-June 2008 (Program in hyperbolic dynamics)
24. Centro Ennio di Giorgi, Scuola Normale Superiore, Pisa, Italy, May-July 2006 (Prof. Marmi)
25. Institut Henri Poincaré, Paris, France, May-June 2005 (Program in ergodic theory)
26. University of Surrey, Guildford, England, May 2005 (Profs. Melbourne and Bruin)
27. University of Rome, Tor Vergata, Italy, June 2004 (Prof. Liverani)

Professional Memberships and Service

Editorial Board: Associate Editor, Discrete and Continuous Dynamical Systems – Series A
Associate Editor, Nonlinearity

Conferences Organized:

1. *Probabilistic Techniques for Random and Time-Dependent Dynamical Systems,* International conference at Centre International de Rencontres Mathematiques, Luminy, France. October 2022

2. *Dynamics, Transfer Operators and Spectra,* January – June 2021
   Research Semester at Centre Interfacultaire Bernoulli, École Polytechnique Fédérale de Lausanne, Switzerland.

3. *Anisotropic Spaces and their Application to Hyperbolic and Parabolic Systems,* June 2019
   Research school at Mathematisches Forschungsinstitut Oberwolfach, Germany.

4. *New Developments in Open Dynamical Systems and Their Applications,* March 2018
   Banff International Research Station, Canada.
5. *International Conference on Statistical Properties of Nonequilibrium Dynamical Systems,* July 27 – August 2, 2016
   South University of Science and Technology of China, Shenzhen, China. Conference preceded by three-week workshop offering minicourses for young researchers and students, July 4 – July 26, 2016.

6. *Stochastic methods for nonequilibrium dynamical systems,* June 1 – 5, 2015
   Workshop held at the American Institute of Mathematics, Palo Alto, California.

Journal Referee: Annales de l'Institut Henri Poincaré
Communications in Mathematical Physics
Discrete and Continuous Dynamical Systems
Ergodic Theory and Dynamical Systems
Journal of Modern Dynamics
Journal of Physics A: Mathematical and Theoretical
Journal of Statistical Physics
Lecture Notes in Mathematics
Mathematika
Memoirs of the American Mathematical Society
Monatshefte für Mathematik
Nonlinearity
Physica D: Nonlinear Phenomena
Real Analysis Exchange
Revista Matemática Complutense
Transactions of the American Mathematical Society

Member: American Mathematical Society
Pi Mu Epsilon (Mathematical Honor Society)

Other Work and Teaching Experience

Graduate Assistant, New York University. 1998-2003
1 year served as Teaching Assistant; 4 years served as lead instructor.

Instructor, Marymount College, Tarrytown, NY. Summer 1999
Taught College Algebra summer course.

Vice Principal of Academic Affairs, Saramen Chuuk Academy, Micronesia. 1996 - 1997
Coordinated school-wide effort to help teachers create curriculum guides for high school course sequences. Evaluated teacher performance through classroom visits and individual

conferences. Organized after-school program for at-risk students. Wrote successful grant proposal to expand language lab for freshman English Skills.

Teacher, Saramen Chuuk Academy, Chuuk State, Micronesia. 1994-1997
Taught mathematics and English literature and composition to high school juniors and seniors as a member of the Jesuit International Volunteers program.