

**Daniel H. Rothman**  
Lorenz Center  
Department of Earth, Atmospheric, and Planetary Sciences  
Massachusetts Institute of Technology  
Cambridge, Massachusetts 02139  
dhr@mit.edu, (617) 253-7861  
<https://web.mit.edu/dhr/site>  
January, 2024

## **Education**

September, 1975– June, 1979     Brown University, Providence, Rhode Island, A.B.,  
Applied Mathematics.

March, 1982– January, 1986     Stanford University, Stanford, California, Ph.D., Geophysics.  
Dissertation: Large near-surface anomalies, seismic reflection  
data, and simulated annealing  
Advisor: Prof. Jon F. Claerbout

## **Employment**

August, 1979– December, 1981     Research Geophysicist, Western Geophysical Company,  
Houston, Texas and London, England.

March, 1986– August, 1986     Visiting Scientist, Department of Earth, Atmospheric, and  
Planetary Sciences, MIT, Cambridge, MA.

September, 1986– June, 1990     Assistant Professor of Geophysics, Department of Earth,  
Atmospheric, and Planetary Sciences, MIT, Cambridge, MA.

July, 1990– June, 1991     Associate Professor (Untenured) of Geophysics, Department of Earth,  
Atmospheric, and Planetary Sciences, MIT, Cambridge, MA.

July, 1991– June, 1996     Associate Professor (Tenured) of Geophysics, Department of Earth,  
Atmospheric, and Planetary Sciences, MIT, Cambridge, MA.

July, 1996– present     Professor of Geophysics, Department of Earth, Atmospheric,  
and Planetary Sciences, MIT, Cambridge, MA.

## **Selected visiting appointments**

Winter, 1992     Visiting Professor, Department of Geophysical Sciences  
and The James Franck Institute, The University of Chicago.

Fall, 1992     Professeur Invité, Ecole des Mines de Paris, France.

- January, 1993– August, 1993    Directeur de Recherche Associé, Laboratoire de Physique Statistique, Centre National de la Recherche Scientifique, Ecole Normale Supérieure, Paris, France.
- Summer, 1994    Professeur Invité, Ecole Normale Supérieure, Paris, France.
- Summer, 1995    Physicien Invité, Institut Physique du Globe, Paris, France.
- Summer, 1997    Professeur Invité, Université de Paris VII, Paris, France.
- 2007–2008    Fellow, Radcliffe Institute for Advanced Study, Harvard University.
- Fall, 2016    Visiting Professor, Université de Paris Diderot, Paris, France.

### **Honors**

- Outstanding Paper in *Geophysics* (1986) (Publication 2.3)
- MIT Global Habitat Longevity Award (2007) [for “an important contribution to the scientific understanding of trends, phenomena, principles, and/or impact of natural or man-made phenomena on the long term evolution and health of the habitat and environment of Earth”]
- Jeanne Rosselet Fellow, Radcliffe Institute for Advanced Study (2007–2008).
- Fellow, American Physical Society (2012)
- Fellow, American Geophysical Union (2014)
- Levi L. Conant Prize, American Mathematical Society (2016) [for “the best expository paper published in either the *Notices of the AMS* or the *Bulletin of the AMS* in the preceding five years” (Publication 2.93)]

### **Doctoral dissertations supervised (and current academic position)**

- Andrew Gunstensen, Lattice-Boltzmann studies of multiphase flow through porous media, Ph.D., Geophysics, 1992.
- John Olson, Two-phase flow in sedimentary rock: complexity, transport, and simulation, Ph.D., Geophysics, December, 1995.
- Einat Aharonov, Solid-fluid interactions: processes that form rocks, Ph.D., Geophysics, December, 1995 (Professor, Institute of Earth Sciences, Hebrew University, Jerusalem, Israel).
- Olav van Genabeek, Velocity fluctuations in slow flow through porous media, Ph.D., Geophysics, July, 1998.
- Peter Dodds, Geometry of river networks, Ph.D., Applied Mathematics, June, 2000 (Professor, Department of Mathematics and Statistics, University of Vermont).

- Davide Stelitano, Elastic interfaces in fluids: Lattice-Boltzmann model and applications, Ph.D., Physics, June, 2000.
- Joshua Weitz, Generalized contact processes in ecology, Ph.D., Physics, June, 2003 (Professor, Department of Biology, Georgia Institute of Technology).
- Alexander Petroff, Streams, stromatolites, and the geometry of growth, Ph.D., Geophysics, June 2011 (Assistant Professor, Department of Physics, Clark University).
- David Forney, Carbon transit through degradation networks, Ph.D., Mechanical Engineering, June 2012.
- Christopher Follett, Heterogeneous reservoirs in the marine carbon cycle, Ph.D., MIT/WHOI Joint Program in Chemical Oceanography, March 2014 (Lecturer, School of Environmental Sciences, U. Liverpool).
- Robert Yi, Emergent geometries of groundwater-fed rivers, Ph.D., Geophysics, September 2017.
- Haitao Shang, Theory and evolutionary evidence of the autocatalytic oxygenation of Earth, Ph.D., Earth, Atmospheric, and Planetary Sciences (GGG program), September 2021 (Postdoc, U. Oregon)
- Eric Stansifer, Theory of the growth and shape of Laplacian stream networks, Ph.D., Geophysics (PAOC program), January 2022.
- Constantin Arnscheidt, Four problems in nonlinear Earth system dynamics, Ph.D., Earth, Atmospheric, and Planetary Sciences (PAOC program), May 2023 (Postdoc, Cambridge Center for the Study of Existential Risk)

#### **Post-doctoral researchers supervised (and current academic position)**

- Eirik Grude Flekkoy, 1993–1994, Professor of Physics, University of Oslo, Norway.
- Romualdo Pastor-Satorras, 1996–1998, Associate Professor of Applied Physics, Universitat Politècnica de Catalunya, Barcelona, Spain.
- Norbert Schorghofer, 2000–2002, Associate Astronomer, University of Hawaii at Manoa.
- Alexander Lobkovsky, 2002–2007, IRTA Fellow, National Center for Biotechnology Information, National Institutes of Health.
- Mika Latva-Kokko, 2002–2005, Physics Instructor, Phillips-Andover Academy.
- Daniel Abrams, 2006-2009, Associate Professor, Department of Engineering Sciences and Applied Mathematics, Northwestern University.
- Olivier Devauchelle, 2008–2010, Institut Physique du Globe de Paris, CNRS, Paris, France.
- Daniel Reeves, 2010–2012.

- Hansjoerg Seybold, 2010–2014, ETH-Zurich, Switzerland.
- Yossi Cohen, 2012–2017.

### **Recent courses taught**

- Nonlinear Dynamics: Chaos (12.006J/18.353J/2.050J) (*renewed: Fall, 2022*)
- Modeling Environmental Complexity (12.086 / 12.586)
- Seminar on Feast, Famine, and Microbial Persistence (12.S492) (*new: Spring, 2024*)
- Seminar on Humanity, the Earth System, and the Long-Term Future (12.S597) (*new: Spring, 2022*)
- Seminar on The Persistence of Earth’s Biosphere (12.S597) (*new: Fall, 2021*)
- Seminar on The Balance of Nature (12.S593) (*new: Spring, 2021*)
- Nonlinear Dynamics: The Natural Environment (12.009J / 18.352J)

### **Selected synergistic activities**

- Co-organizer of “Tropical Cyclones, Convection, and Climate: A Symposium in Honor of Kerry Emanuel,” MIT, June 2022.
- MIT organizer of “Numbers and Nature: Honoring the Scientific Legacy of Mitchell Feigenbaum,” MIT, June 2022.
- Member, Nomination Committee of the Topical Group on the Physics of Climate, American Physical Society, 2022.
- Member, Nomination Committee of the Topical Group on Statistical and Nonlinear Physics, American Physical Society, 2022.
- Member, Dissertation Award Committee, Group on Statistical and Nonlinear Physics, American Physical Society, 2021.
- Member at Large, American Physical Society Topical Group on the Physics of Climate, 2013–2015, 2018–2020.
- Member, Program Committee of the Topical Group on the Physics of Climate, American Physical Society, 2012–2014.
- Co-founder of the Lorenz Center at MIT, a privately funded interdisciplinary research center devoted to learning how climate works, 2011.
- Chair of the Committee on Mathematical Geophysics of the International Union of Geodesy and Geophysics, 2000–2011.
- Associate Editor of *Physical Review E*, 1998–2001.

- Member, Editorial Board of the *Journal of Statistical Physics*, 1997–1999.
- Secretary of the Committee on Mathematical Geophysics of the International Union of Geodesy and Geophysics, 1993–2000.
- Member, MIT Committee on the Undergraduate Program, 1996–1999.

### **Recent MIT/EAPS Community Service**

- Member, EAPS faculty search committee (2023-24).
- Member, EAPS faculty search committee (2022-23).
- Chair, EAPS Admissions Committee, 2016–
- Co-organizer of “Tropical Cyclones, Convection, and Climate: A Symposium in Honor of Kerry Emanuel,” MIT, June 2022.
- Member, EAPS promotion committee for a junior faculty member, 2022.
- Member, PAOC Curriculum Committee, 2021-22.
- Co-Chair or Member, EAPS Distinguished Postdoctoral Fellowship Selection Committee, 2019–2021.
- Chair, Mentor committee for a junior faculty member, 2018–2022
- Member, Mentor committee for a junior faculty member, 2019–
- Member, Full Professor Promotion Committee for a junior faculty member, 2020.
- Member, PAOC General Exam Committee, 2018–2019.
- Chair, PAOC General Exam Committee, 2017–2018.

### **Selected recent public outreach**

- Podcast for *Geology Bites*, entitled “Thresholds of Catastrophe in the Earth System,” February 2023.
- Organization and hosting of the annual Carlson Lecture, a public lecture series devoted to the science of climate.
- Interview in *Ice on Fire*, an HBO documentary directed by Leila Connors and produced and narrated by Leonardo DiCaprio, 2019.

### **Invited lectures since 2004**

- Physics Department Colloquium, University of Toronto, January 2004.
- Applied Math Lab Seminar, Courant Institute of the Mathematical Sciences, New York University, January 2004.

- Gordon Research Conference on Granular and Granular-Fluid Flow, Colby College, June 2004.
- IGERT Joint Program Colloquium in Applied Mathematics and Earth and Environmental Science, Columbia University, September 2004.
- Sixth Annual Boston Area Statistical Mechanics Meeting, Brandeis University, October 2004.
- Department of Physics Colloquium, University of Massachusetts-Amherst, October 2004.
- Department of Earth Science Colloquium, Dartmouth College, January 2005.
- Department of Geology and Geophysics Colloquium, Yale University, January 2005.
- Hoffman Group Seminar, Department of Earth and Planetary Sciences, Harvard University, May 2005.
- Department of Mechanical Engineering Colloquium, University of Illinois at Urbana-Champaign, October 2005.
- Department of Physics Colloquium, Northeastern University, November 2005.
- Widely Applied Math Seminar, Division of Engineering and Applied Science, Harvard University, February 2006.
- Department of Geophysics Colloquium, Stanford University, February 2006.
- Stanford Exploration Project Seminar, Department of Geophysics, Stanford University, February 2006.
- Department of Physics Colloquium, Brandeis University, March 2006.
- Sandia National Laboratories Geosciences Distinguished Lecture, March 2006.
- 26th Conference on Mathematical Geophysics, Sea of Galilee, Israel, June 2006.
- 16th Annual V.M. Goldschmidt Conference 2006, Melbourne, Australia, August 2006.
- 2006 Annual Meeting of the Norwegian Physical Society, Wadahl, Norway, September 2006.
- Department of Earth Sciences Colloquium, Boston University, October 2006.
- 15th 'Aha Huliko'a Winter Workshop on Physical Oceanography, University of Hawaii, January 2007.
- Biophysics Group Seminar, Department of Physics, MIT, March 2007.
- Robert Berg Lecture, Department of Geology and Geophysics, Texas A&M University, March 2007.
- St. Anthony Falls Laboratory Seminar, University of Minnesota, April, 2007.

- IUGG XXIV General Assembly, Perugia, Italy, July 2007.
- Radcliffe Institute for Advanced Study, Harvard University, October 2007.
- School of Chemistry Colloquium, Weizmann Institute of Science, Israel, November 2007.
- Widely Applied Math Seminar, Division of Engineering and Applied Science, Harvard University, November 2007.
- 98th Statistical Mechanics Meeting, Rutgers University, December 2007.
- Department of Earth System Science Colloquium, University of California-Irvine, January 2008.
- Seminar in Biological and Biomedical Sciences, University of New Mexico, February 2008.
- Santa Fe Institute Colloquium, February 2008.
- March Meeting of the American Physical Society, March 2008.
- Department of Geological Sciences Colloquium, University of Colorado-Boulder, April 2008.
- Optimal Transport Workshop III: Transport Systems in Geography, Geosciences, and Networks, Institute for Pure & Applied Mathematics, UCLA, May 2008
- Alpine Summer School XVI, Interaction and Coevolution of Climate and Biosphere, Val-savarenche, Valle d'Aosta, Italy, June, 2008.
- Department of Physics Colloquium, Georgia Institute of Technology, November 2008.
- Symposium in Honor of Jens Feder, Norwegian Academy of Science and Letters, January 2009.
- Applied Mathematics Colloquium, Northwestern University, February 2009
- Computations in Science Seminar, Department of Physics, University of Chicago, February 2009.
- Department of Geological Sciences Colloquium, Indiana University, April 2009.
- Ovalline Lecturer in Geological Sciences (3 lectures), Jackson School of Earth Sciences, University of Texas, May 2009.
- Nonlinear Dynamics Seminar, Department of Physics, University of Texas, May 2009.
- Environmental Geology and Geochemistry Seminar, Princeton University, October 2009
- Department of Earth and Planetary Sciences Colloquium, Harvard University, October 2009
- International Workshop on the Comparative Study of the Precambrian-Cambrian and Permian-Triassic Transitions, Nanjing, China, November 2009.

- American Geophysical Union Fall Meeting, San Francisco, CA, December 2009.
- Oceanography Sack Lunch Series, MIT, February 2010.
- First Tuesday Colloquium, James Franck Institute, University of Chicago, March 2010.
- Computations in Science Seminar, Department of Physics, University of Chicago, March 2010.
- Physical Applied Mathematics Seminar, MIT, April 2010.
- Summer School on Environmental Dynamics, Istituto Veneto di Scienze Lettere ed Arte, June 2010 (4 lectures).
- Department of Earth and Environmental Science, University of Pennsylvania, October 2010.
- Northeastern Granular Materials Workshop, MIT, June 2011.
- Workshop on Complex Phenomena in Materials, Porto de Galinhas, Brazil, January 2012.
- Ocean Sciences Meeting, Salt Lake City, Utah, February 2012.
- Department of Physics Colloquium, University of New Mexico, Albuquerque, NM, March 2012.
- Institut Physique du Globe de Paris Colloquium, Paris, France, March 2012.
- Center for Studies in Physics and Biology Seminar, Rockefeller University, New York, NY, April 2012
- International Workshop on Soft-Matter Physics and Complex Flows, Svolvær, Lofoten, Norway, May 2012.
- IUGG Conference on Mathematical Geophysics, Edinburgh, Scotland, June 2012.
- Fermor Meeting on the Neoproterozoic, Geological Society of London, London, England, September 2012.
- Vermont Complex Systems Center Colloquium, University of Vermont, September 2012.
- Outcomes of Graduate Education: from Condensed Matter to Biological Physics (LeoFest, in honor of Leo P. Kadanoff), University of Chicago, October 2012.
- Special Seminar, Institut d'Alembert, Université Pierre et Marie Curie, Paris, France, June 2013.
- Cyberseminar, Consortium of Universities for the Advancement of Hydrologic Science, November 2013.
- American Geophysical Union Fall Meeting, San Francisco, CA (two invited talks), December 2013.



- Current Events Bulletin, American Mathematical Society, Joint Mathematics Meeting, Baltimore, MD, January 2014.
- Lorenz Center Workshop on Water and Climate, Dedham, MA, February 2014.
- Physics Colloquium, MIT, February 2014.
- Workshop on Reacting and Deformable Porous Media, Oxford University, March 2014.
- Physical Applied Mathematics Seminar, MIT, April 2014.
- Dynamics Days, Rice University, Houston, TX, January 2015.
- Origins of Extinction Workshop, Arizona State University, Tempe, AZ, February 2015.
- American Physical Society March Meeting, San Antonio, TX, March 2015.
- European Geophysical Union, Vienna, Austria, April 2015.
- Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology, Newark, NJ, June 2015.
- Computations in Science Seminar, James Franck Institute, University of Chicago, November 2015.
- American Geophysical Union Fall Meeting, San Francisco, CA, December 2015.
- First MIT Meeting on Quantitative Ecology, MIT, January 2016.
- Institute for Quantitative Theory and Methods Seminar, Emory University, Atlanta, GA, February 2016.
- Mathematics and Climate Research Network (webinar), February 2016.
- Evolution of Life (One Day meeting), Cambridge Philosophical Society, Cambridge University, Cambridge, England, March 2016.
- International Institute of Physics Workshop on Physics and Mathematics of Complex Systems: Growing Interfaces, Nonlinear Dynamics, Integrability, Natal, Brazil, April 2016.
- Plenary Speaker, Society for Industrial and Applied Mathematics (SIAM) Conference on Mathematics of Planet Earth, Philadelphia, PA, September 2016.
- Levi L. Conant Lecture, Worcester Polytechnic Institute, Worcester, MA, September 2016.
- Widely Applied Math Seminar, School of Engineering and Applied Science, Harvard University, September 2016.
- Memorial Symposium for Leo Kadanoff, University of Chicago, October 2016.
- BioLunch Seminar, Department of Applied Mathematics and Theoretical Physics, Cambridge University, Cambridge, UK, November 2016.

- Mathematics of Planet Earth Centre for Doctoral Training, Imperial College, London, November 2016.
- Geological Fluid Dynamics Seminar, Institut de Physique du Globe de Paris, France, December 2016.
- American Geophysical Union Fall Meeting, San Francisco, CA, December 2016.
- Gordon Conference on Metals in Biology, Ventura California, January 2017.
- Society for Industrial and Applied Mathematics (SIAM) Conference on Computational Science and Engineering, Atlanta, GA, March 2017.
- The Shape of Rivers: Perspectives from Art and Science, DeCordova Museum, Lincoln, MA, March 2017 (with Fritz Horstman).
- American Geophysical Union Fall Meeting, New Orleans, LA, December 2017.
- Geophysical Fluid Dynamics Institute, Florida State University, Tallahassee, FL, January 2018.
- Theory Lunch, Department of Systems Biology, Harvard Medical School, February 2018.
- Department of Earth Science Colloquium, Dartmouth College, Hanover, NH, April 2018.
- Frontiers in Metallobiochemistry (37th Summer Symposium in Molecular Biology), Pennsylvania State University, University Park, PA, June 2018.
- IGERT Summer Institute on Geometry and Dynamics, Brandeis University, June 2018.
- National Center for Earth Dynamics Summer Institute, University of Minnesota, July 2018.
- Goldschmidt Meeting, Boston, MA, August 2018.
- International Carbon Conference, Reykjavik, Iceland, September 2018.
- PAOC Colloquium, MIT, December 2018.
- Dynamics Days 2019, Northwestern University, January 2019.
- Frontiers in Nonlinear and Stochastic Modeling of Mass Extinction, Mathematical Biosciences Institute, Ohio State University, Columbus OH, March 2019.
- Heiland Lecture, Department of Geophysics, Colorado School of Mines, April 2019.
- Special Lecture, Department of Geophysics, Colorado School of Mines, April 2019.
- SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, May 2019.
- Fifth Conference on Computational and Mathematical Population Dynamics, Miami, Florida, May 2019.

- Goldschmidt Meeting (Keynote), Barcelona, Spain, August 2019.
- Boston University Dynamical Systems Seminar, February 2020.
- Physics Colloquium, Clark University, Worcester, MA, March 2020. *Postponed*
- American Physical Society March Meeting, March 2021.
- $k \log W$  Seminar of the Group on Statistical and Nonlinear Physics of the American Physical Society (virtual), June 2021.
- MIT Club of Northern California (virtual), September 2021.
- MIT EAPS Department Lecture Series, November 2021.
- 7th Warsaw School of Statistical Physics (4 lectures), Sandomierz, Poland, 27 June–1 July 2022.
- Dynamical Systems Seminar, Division of Applied Mathematics, Brown University, Providence, RI, September 2022.
- Department of Geology Seminar, Trinity College, Dublin, Ireland, November 2022.
- Department of Geological Sciences Colloquium, University of Colorado, Boulder, December 2022.
- Applied Mathematics Colloquium, University of Colorado, Boulder, December 2022.
- Department of Physics Colloquium, Boston University, February 2023.
- SIAM Conference on Applications of Dynamical Systems, Portland, Oregon, May 2023.
- EPFL Workshop on Complex Systems, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland, September 2023.
- MIT-PAOC Colloquium, December 2023.
- Environmental Science and Engineering Seminar, California Institute of Technology, Pasadena, CA, January 2024.
- American Physical Society March Meeting, March 2024.
- Department of Physics Colloquium, Clark University, April 2024.
- Models in Population Dynamics, Ecology and Evolution (MPDEE-24), Leicester, UK, April 2024.

## Publications of Daniel H. Rothman

### 1. Books

1. Rothman, D. H. and Zaleski, S., *Lattice-Gas Cellular Automata: Simple models of complex hydrodynamics*, Cambridge University Press, 1997.

### 2. Papers in refereed journals

1. Rothman, D. H., Levin, S., and Rocca, F., "Residual migration: applications and limitations," *Geophysics* **50**, 110-126, January 1985.
2. Rothman, D. H., "Nonlinear inversion, statistical mechanics, and residual statics estimation," *Geophysics* **50**, 2784-2796, December 1985.
3. Rothman, D. H., "Automatic estimation of large residual statics corrections," *Geophysics* **51**, 332-346, February 1986.
4. Rothman, D. H., "Modeling seismic P-waves with cellular automata," *Geophysical Research Letters* **14**, 17-20, January 1987.
5. Rothman, D. H., "Cellular-automaton fluids: a model for flow in porous media," *Geophysics* **53**, 509-518, April 1988.
6. Rothman, D. H. and Keller, J.M., "Immiscible cellular-automaton fluids," *Journal of Statistical Physics* **52**, 1119-1127, August 1988.
7. Rothman, D. H., "Negative-viscosity lattice gases," *Journal of Statistical Physics* **56**, 517-524, August 1989.
8. Rothman, D. H. and Zaleski, S., "Spinodal decomposition in a lattice-gas automaton," *Journal de Physique (France)* **50**, 2161-2174, August 1989.
9. Rothman, D. H., "Macroscopic laws for immiscible two-phase flow in porous media: results from numerical experiments," *Journal of Geophysical Research* **95**, 8663-8674, June 1990.
10. Cancelliere, A., Chang, C., Foti, E., Rothman, D. H., and Succi, S., "The permeability of a random medium: comparison of simulation with theory," *Physics of Fluids A* **2**, 2085-2088, December 1990.
11. Rothman, D. H., "Deformation, growth, and order in sheared spinodal decomposition," *Physical Review Letters* **65**, 3305-3308, December 24, 1990.
12. Gunstensen, A. and Rothman, D. H., "A lattice-gas model for three immiscible fluids," *Physica D* **47**, 47-52, January, 1991.
13. Gunstensen, A. and Rothman, D. H., "A Galilean-invariant immiscible lattice gas," *Physica D* **47**, 53-63, January, 1991.

14. Appert, C., Rothman, D. H., and Zaleski, S., "A liquid-gas model on a lattice," *Physica D* **47**, 85-96, January, 1991.
15. Rothman, D. H., "Complex rheology in a model of a phase-separating fluid," *Europhysics Letters* **14**, 337-342, February 15, 1991.
16. Gunstensen, A., Rothman, D. H., Zaleski, S., and Zanetti, G., "A lattice-Boltzmann model of immiscible fluids," *Physical Review A* **43**, 4320-4327, April 15, 1991.
17. Gunstensen, A. and Rothman, D. H., "Microscopic modeling of immiscible fluids in three dimensions by a lattice-Boltzmann method," *Europhysics Letters* **18**, 157-161, February 14, 1992.
18. Holme, R. and Rothman, D. H., "Lattice-gas and lattice-Boltzmann models of miscible fluids," *Journal of Statistical Physics* **68**, 409-430, August, 1992.
19. Gunstensen, A. and Rothman, D. H., "Lattice-Boltzmann studies of immiscible two-phase flow through porous media," *Journal of Geophysical Research* **98**, 6431-6441, April, 1993.
20. Aharonov, E. and Rothman, D. H., "Non-Newtonian flow (through porous media): a Lattice Boltzmann method," *Geophysical Research Letters* **20**, 679-682, April, 1993.
21. Rothman, D. H., "From ordered bubbles to random stripes: pattern formation in a hydrodynamic lattice gas," *Journal of Statistical Physics* **71**, 641-652, May, 1993.
22. Rothman, D. H., Grotzinger, J., and Flemings, P., "Scaling in turbidite deposition," *Journal of Sedimentary Research* **A64**, 59-67, January, 1994.
23. Adler, C., d'Humières, D., and Rothman, D. H., "Surface tension and interface fluctuations in immiscible lattice gases," *Journal de Physique I (France)* **4**, 29-46, January, 1994.
24. Rothman, D. H. and Kadanoff, L. P., "Bubble, bubble, boil and trouble," *Computers in Physics* **8**, 199-204, March/April, 1994.
25. Rothman, D. H. and Zaleski, S., "Lattice-gas models of phase separation: interfaces, phase transitions, and multiphase flow," *Reviews of Modern Physics* **66**, 1417-1479, October, 1994.
26. Flekkøy, E. and Rothman, D. H., "Fluctuating fluid interfaces," *Physical Review Letters* **75**, 260-263, July 10, 1995.
27. Ferréol, B. and Rothman, D. H., "Lattice-Boltzmann simulations of flow through Fontainebleau sandstone," *Transport in Porous Media* **20**, 3-20, August, 1995.
28. Rothman, D. H. and Grotzinger, J., "Scaling properties of gravity-driven sediments," *Non-linear Processes in Geophysics* **2**, 178-185, September, 1995.
29. Olson, J. and Rothman, D. H., "A three-dimensional immiscible lattice gas: application to sheared phase separation," *Journal of Statistical Physics* **81**, 199-222, October, 1995.

30. Adler, C., Boghosian, B., Flekkøy, E., Margolus, N., and Rothman, D. H., “Simulating three-dimensional hydrodynamics on a cellular-automata machine,” *Journal of Statistical Physics* **81**, 105–128, October, 1995.
31. Appert, C., Olson, J., Rothman, D. H., and Zaleski, S., “Phase separation in a three-dimensional two-phase hydrodynamic lattice gas,” *Journal of Statistical Physics* **81**, 181–197, October, 1995.
32. Flekkøy, E. and Rothman, D. H., “Fluctuating hydrodynamic interfaces: theory and simulation,” *Physical Review E* **53**, 1620–1641, February, 1996.
33. Aharonov, E. and Rothman, D. H., “Growth of correlated pore-scale structures in sedimentary rocks: a dynamical model,” *Journal of Geophysical Research* **101**, 2973–2987, February, 1996.
34. van Genabeek, O. and Rothman, D. H., “Macroscopic manifestations of microscopic flows through porous media: phenomenology from simulation,” *Annual Review of Earth and Planetary Sciences* **24**, 63–87, 1996.
35. Auzeais, F.M., Dunsmuir, J., Ferréol, B., Marty, N., Olson, J., Ramakrishnan, T. S., Rothman, D. H., and Schwartz, L. M., “Transport in sandstone: a study based on three-dimensional microtomography,” *Geophysical Research Letters* **23**, 705–708, April 1, 1996.
36. Grotzinger, J. and Rothman, D. H., “An abiotic model for stromatolite morphogenesis,” *Nature* **382**, 423–425, October 3, 1996.
37. Pot, V., Appert, C., Melayah, A., Rothman, D. H., and Zaleski, S., “Interacting lattice-gas automaton study of liquid-gas properties in porous media,” *Journal de Physique II France* **6**, 1517–1534, October, 1996.
38. Olson, J. and Rothman, D. H., “Two-phase flow in sedimentary rock: simulation, transport, and complexity,” *Journal of Fluid Mechanics* **341**, 343–370, June 25, 1997.
39. Aharonov, E., Rothman, D. H., and Thompson, A., “Transport properties and diagenesis in sedimentary rocks: the role of microscale geometry,” *Geology* **25**, 547–550, June, 1997.
40. Rothman, D. H., “Oscillons, spiral waves, and stripes in a model of vibrated sand,” *Physical Review E* **57**, R1239–R1242, February, 1998.
41. Pastor-Satorras, R. and Rothman, D. H., “Stochastic equation for the erosion of inclined topography,” *Physical Review Letters* **80**, 4349–4352, May 11, 1998.
42. Pastor-Satorras, R. and Rothman, D. H., “Scaling of a slope: the erosion of tilted landscapes,” *Journal of Statistical Physics* **93**, 477–500, November, 1998.
43. Dodds, P. and Rothman, D. H., “Unified view of scaling laws for river networks,” *Physical Review E* **59**, 4865–4877, May, 1999.
44. van Genabeek, O. and Rothman, D. H., “Critical behavior in flow through a rough-walled channel,” *Physics Letters A* **255**, 31–316, May 3, 1999.

45. Dodds, P. and Rothman, D. H., “Scaling, universality, and geomorphology,” *Annual Review of Earth and Planetary Sciences* **28**, 571–610, 2000.
46. Stelitano, D. and Rothman D. H., “Fluctuations of elastic interfaces in fluids: Theory, lattice-Boltzmann model, and simulation,” *Physical Review E* **62** 6667–6680, November, 2000.
47. Dodds, P. and Rothman D. H., “Geometry of River Networks I: Scaling, Fluctuations, and Deviations,” *Physical Review E* **63**, 016115 (13 pages), January, 2001.
48. Dodds, P. and Rothman D. H., “Geometry of River Networks II: Distributions of Component Size and Number,” *Physical Review E* **63**, 016116 (15 pages), January, 2001.
49. Dodds, P. and Rothman D. H., “Geometry of River Networks III: Characterization of Component Connectivity,” *Physical Review E* **63**, 016117 (10 pages), January, 2001.
50. Schorghofer, N. and Rothman D. H., “Basins of attraction on random topography,” *Physical Review E* **63**, 026112 (7 pages), February, 2001.
51. Dodds, P., Rothman, D. H., and Weitz, J., “Re-examination of the ‘3/4-law’ of metabolism,” *Journal of Theoretical Biology* **209**, 9–27, March, 2001.
52. Rothman, D. H., “Global biodiversity and the ancient carbon cycle,” *Proceedings of the National Academy of Sciences USA* **98**, 4305–4310, April 10, 2001.
53. Chan, K. and Rothman, D. H., “Coupled length scales in eroding landscapes,” *Physical Review E* **63**, 055102(R) (4 pages), May, 2001.
54. Aharonson O., Zuber, M., and Rothman, D. H., “Statistics of Mars’ topography from the Mars Orbiter Laser Altimeter: Slopes, correlations, and physical models,” *Journal of Geophysical Research* **106**, 23723–23735, October 25, 2001.
55. Aharonson O., Zuber, M., Rothman, D. H., Whipple, K., and Schorghofer, N., “Drainage basins and channel incision on Mars,” *Proceedings of the National Academy of Sciences USA* **99**, 1780-1783, February 19, 2002.
56. Rothman, D. H., “Atmospheric carbon dioxide levels for the last 500 million years,” *Proceedings of the National Academy of Sciences USA* **99**, 4167-4171, April 2, 2002.
57. Schorghofer, N. and Rothman, D. H., “Acausal relations between topographic slope and drainage area,” *Geophysical Research Letters* **29**, 10.1029/2002GL015144, 2002.
58. Rothman, D.H., Hayes, J. M., and Summons, R.E., “Dynamics of the Neoproterozoic carbon cycle” *Proceedings of the National Academy of Sciences USA* **100**, 8124-8129, July 8, 2003.
59. Weitz, J. S. and Rothman, D. H., “Scale-dependence of resource-biodiversity relationships,” *Journal of Theoretical Biology* **225**, 205-214, November 21, 2003.
60. Schorghofer, N., Jensen, B., Kudrolli, A., and Rothman, D. H., “Spontaneous channelization in permeable ground: Theory, experiment, and observation” *Journal of Fluid Mechanics* **503**, 357-374, March 2004.

61. Weitz, J. S. and Rothman, D. H., “Dynamics of a contact process with ontogeny,” *Physical Review E* **70**, 021915, August 2004.
62. Lobkovsky, A.E., Jensen, B., Kudrolli, A., and Rothman, D. H., “Threshold phenomena in erosion driven by subsurface flow,” *Journal of Geophysical Research-Earth Surface* **109**, Art. No. F04010, December 24, 2004.
63. Latva-Kokko, M. and Rothman, D. H., “Diffusion properties of gradient-based lattice Boltzmann models of immiscible fluids,” *Physical Review E* **71**, 056702, May 2005.
64. Latva-Kokko, M. and Rothman, D. H., “Static contact angle in lattice-Boltzmann models of immiscible fluids,” *Physical Review E* **72**, 046701, October 2005.
65. Lobkovsky, A.E., Smith, B. E., Kudrolli, A., Mohrig, D., and Rothman, D. H., “Erosive dynamics of channels incised by subsurface water flow,” *Journal of Geophysical Research-Earth Surface* **112**, F03S12, doi:10.1029/2006JF000517, March 2007.
66. Rothman, D.H. and Forney, D. C., “Physical model for the decay and preservation of marine organic carbon,” *Science* **316**, 1325–1328, June 1, 2007.
67. Latva-Kokko M. and Rothman D.H., “Scaling of dynamic contact angles in a lattice-Boltzmann model,” *Physical Review Letters* **98**, Art. No. 254503, June 22, 2007.
68. Straub, K.M, Jerolmack, D.J., Mohrig, D., and Rothman, D.H., “Channel network scaling laws in submarine basins,” *Geophysical Research Letters* **34**, L12613, doi:10.1029/2007GL030089, June 2007.
69. Rothman, D.H. and Forney, D. C., “Response to Comment on ‘Physical model for the decay and preservation of marine organic carbon’,” *Science* **319**, doi:10.1126/science.1148678, March 21, 2008
70. Lobkovsky, A. E., Orpe, A. V., Molloy, R., Kudrolli, A., and Rothman, D. H., “Erosion of a granular bed driven by laminar fluid flow,” *Journal of Fluid Mechanics*, **605**, June 25, 2008
71. Smith, B., Kudrolli, A., Lobkovsky, A. E., and Rothman, D. H., “Channel erosion due to subsurface flow,” *Chaos* **18**, 041105 (1 page), DOI:10.1063/1.2997333, December 31, 2008.
72. Abrams, D. M., Lobkovsky, A. E., Petroff, A. P., Straub, K. M., McElroy, B., Mohrig, D. C., Kudrolli, A, and Rothman, D. H., “Growth laws for channel networks incised by groundwater flow,” *Nature Geoscience* **2**, 193–196, March 2009.
73. Tosca, N. J., Johnston, D. T., Mushegian, A., Rothman, D. H., Summons, R. E., and Knoll, A. H., “Clay mineralogy, organic carbon burial, and redox evolution in Proterozoic basins,” *Geochimica et Cosmochimica Acta* **74**, 1579–1592, 1 March 2010.
74. Vlad, M. O., Rothman, D. H., and Ross, J., “Random channel kinetics for reaction-diffusion systems,” *Physica D* **239**, 739–745, 1 June 2010.



75. Petroff, A. P., Sim, M. S., Maslov, M. A., Krupenin, M., Rothman, D. H., and Bosak, T., “Biophysical basis for the geometry of conical stromatolites,” *Proceedings of the National Academy of Sciences USA*, **107**, 9956–9961, 1 June 2010.
76. Devauchelle, O., Petroff, A. P., Lobkovsky, A. E., and Rothman, D. H. “Longitudinal profile of channels cut by springs,” *Journal of Fluid Mechanics* **667**, 38–48, January 2011.
77. Petroff, A. P., Devauchelle, O., Abrams, D. M., Lobkovsky, A. E., Kudrolli, A., and Rothman, D. H., “Geometry of valley growth,” *Journal of Fluid Mechanics* **673**, 245–254, April 2011.
78. Petroff, A. P., Wui, T.-D., Liang, B., Mui, J., Guerquin-Kern, J. L., Vali, H., Rothman, D. H., and Bosak, T., “Reaction-diffusion model of nutrient uptake in a biofilm: Theory and experiment,” *Journal of Theoretical Biology* **289**, 90–95, November 2011.
79. Shen, S.-Z., Crowley, J. L., Wang, Y., Bowring, S. A., Erwin, D. H., Sadler, P. M., Cao, C.-Q., Rothman, D. H., Henderson, C. M., Ramezani, J., Zhang, H., Shen, Y., Wang, X. D., Wang, W., Mu, L., Li, W.Z., Tang, Y-G., Liu, X. L., Liu, L. J., Zeng, Y., Jiang, Y. F., Jin, Y. G., “Calibrating the End-Permian Mass Extinction,” *Science* **334**, 1367–1372, December 9, 2011.
80. Petroff, A. P., Devauchelle, O., Kudrolli, A., and Rothman, D. H., “Four remarks on the growth of channel networks,” *Comptes Rendus Geoscience* **344**, 33–40, January 2012.
81. Forney, D. C. and Rothman, D. H., “Common structure in the heterogeneity of plant-matter decay,” *Journal of the Royal Society Interface* **9**, 2255–2267, September 7, 2012.
82. Forney, D. C. and Rothman, D. H., “Inverse method for estimating respiration rates from decay time series,” *Biogeosciences* **9** 3601-3612, September 7, 2012
83. Reeves, D. and Rothman, D. H., “Impact of structured heterogeneities on reactive two-phase porous flow,” *Physical Review E* **86**, 031120 (11 pages), 2012.
84. Berhanu, M., Petroff, A. P., Devauchelle, O., Kudrolli, A., and Rothman, D. H. “Shape and dynamics of seepage erosion in a horizontal granular bed,” *Physical Review E* **86** 041304 (9 pages), 2012.
85. Devauchelle, O., Petroff, A. P., Seybold, H., and Rothman, D. H., “Ramification of stream networks,” *Proceedings of the National Academy of Sciences* **109**, 20832-20836, December 18, 2012.
86. Reeves, D. and Rothman, D. H., “Models for age dependence in precipitation and dissolution rates,” *Global Biogeochemical Cycles* **27**, 906-919, September 2013.
87. Petroff, A. P., Beukes, N. J., Rothman, D. H., and Bosak, T., “Biofilm growth and fossil form,” *Physical Review X* **3**, 041012 [14 pages], November 13, 2013.
88. Petroff, A. P., Devauchelle, O., Seybold, H., and Rothman, D. H., “Bifurcation dynamics of natural drainage networks,” *Philosophical Transactions of the Royal Society A* **371**, 20120365, December 13, 2013.

89. Forney, D. C. and Rothman, D. H., "Carbon transit through degradation networks," *Ecological Monographs* **84**, 109-129, February 2014.
90. Rothman, D. H., Fournier, G. P., French, K. L., Alm, E. J., Boyle, E. A., Cao, C., and Summons, R. E., "Methanogenic burst in the end-Permian carbon cycle," *Proceedings of the National Academy of Sciences* **111**, 5462-5467, April 15, 2014.
91. Reeves, D. and Rothman, D. H., "Diffusion and kinetic control of weathering rind development," *Geofluids* **14**, 128-142, May 2014.
92. Follett C., Repeta, D. J., Rothman, D. H., Xu, L., and Santinelli, C., "Hidden cycle of dissolved organic carbon in the deep ocean," *Proceedings of the National Academy of Sciences* **111**, 16706-16711, November 25, 2014.
93. Rothman, D. H., "Earth's carbon cycle: A mathematical perspective," *Bulletin of the American Mathematical Society* **52**, 47-64, January 2015.
94. Cohen, Y. and Rothman, D. H., "Mechanism for mechanical trapping of geologically sequestered carbon dioxide," *Proceedings of the Royal Society A* **20140843** (10 pages), January 21, 2015.
95. Cohen, Y., Devauchelle, O., Seybold, H., Yi, R. S., Szymczak, P., and Rothman D. H., "Path selection in the growth of rivers," *Proceedings of the National Academy of Sciences* **112**, 14132–14137, November 17, 2015.
96. Rothman, D. H., "Mathematical expression of a global environmental catastrophe," *Notices of the American Mathematical Society* **64**, 138–140, February 2017.
97. Seybold, H., Rothman, D. H., and Kirchner, J. W., "Climate's watermark in the geometry of stream networks," *Geophysical Research Letters* **44**, 2272-2280, doi:10.1002/2016GL072089, March 4, 2017.
98. Cohen, Y. and Rothman D. H., "Exact solution for the Poisson field in a semi-infinite strip," *Proceedings of the Royal Society A* **473**, 20160908 DOI: 10.1098/rspa.2016.0908, 17 March 2017.
99. Devauchelle, O., Szymczak, P., Pecelerowicz, M., Cohen, Y, Seybold, H. J., and Rothman, D. H, "Laplacian networks: growth, local symmetry and shape optimization," *Physical Review E* **95**, 033113 (12 pages), <https://doi.org/10.1103/PhysRevE.95.033113>, 24 March 2017.
100. Cohen, Y. and Rothman D. H., "Path selection in a Poisson field," *Journal of Statistical Physics* **167**, 703-712, doi: 10.1007/s10955-016-1669-7, May, 2017.
101. Yi, R., Cohen, Y., Seybold, H., Stansifer, E., McDonald, R., Mineev-Weinstein M., and Rothman, D. H., "A free-boundary model of diffusive valley growth: theory and observation," *Proceedings of the Royal Society A*, DOI: 10.1098/rspa.2017.0159, 21 June 2017.

102. Rothman, D. H., “Thresholds of Catastrophe in the Earth System” *Science Advances* **3**, e1700906, DOI: 10.1126/sciadv.1700906, 20 September 2017.
103. Yi, R., Cohen, Y., Devauchelle, O., Gibbins, G., Seybold, H., and Rothman, D. H., Symmetric rearrangement of groundwater-fed streams, *Proceedings of the Royal Society A* **473**, 20170539, 1 November 2017.
104. Hemingway, J. D., Rothman, D. H., Rosengard, S. Z., and Galy, V. V., “An inverse method to relate organic carbon reactivity to isotope composition from serial oxidation,” *Biogeosciences* **14**, 5099–5114, 15 November 2017.
105. Yi, R., Arredondo, A., Stansifer, E., Seybold, H., and Rothman, D.H., “Shapes of river networks,” *Proceedings of the Royal Society A* **474**, 20180081, 1 July 2018.
106. Hemingway, J. D., Rothman, D. H., Grant, K. E., Rosengard, S. Z., Eglinton, T. I., Derry, L. A., and Galy, V. V., “Mineral protection regulates the global preservation of natural organic carbon,” *Nature* **570**, 228-231, 13 June 2019.
107. Rothman, D. H., “Characteristic disruptions of Earth’s carbon cycle,” *Proceedings of the National Academy of Sciences* **116**, 14813-14822, 23 July 2019.
108. Rothman, D. H., “Carbon-cycle catastrophes: a dynamical-systems perspective,” *SIAM News* **52**, 1, November 2019.
109. Arnscheidt, C. W. and Rothman, D. H., “Routes to global glaciation,” *Proceedings of the Royal Society A* **476**, 20200303, 29 July 2020.
110. Arnscheidt, C. W. and Rothman, D. H., “Asymmetry of extreme Cenozoic climate–carbon cycle events,” *Science Advances* **7**, doi:10.1126/sciadv.abg6864, 11 August 2021.
111. Li, Z., O’Gorman, P. A., and Rothman, D. H., “Tropical precipitation clusters as islands on a rough water-vapor topography,” *Quarterly Journal of the Royal Meteorological Society* **148**, 403–417, January 2022, doi:10.1002/qj.4211,
112. Arnscheidt, C. W. and Rothman, D. H., “The balance of nature: a global marine perspective,” *Annual Review of Marine Science* **14**, 49–73, January 2022.
113. Shang, H., Rothman, D. H., and Fournier, G. P., “Oxidative metabolisms catalyzed Earth’s oxygenation,” *Nature Communications* **13**, 1328, 14 March 2022, <https://doi.org/10.1038/s41467-022-28996-0>
114. Arnscheidt, C. W. and Rothman, D. H., “Rate-induced collapse in evolutionary systems,” *Journal of the Royal Society Interface* **19**, 1 June 2022, <https://doi.org/10.1098/rsif.2022.0182>
115. Arnscheidt, C. W. and Rothman, D. H., “Presence or absence of stabilizing Earth system feedbacks on different time scales,” *Science Advances* **8**, eadc9241, 16 November 2022, DOI: 10.1126/sciadv.adc9241.
116. Rothman, D. H., “Slow closure of Earth’s carbon cycle,” *Proceedings of the National Academy of Sciences* **121**, e2310998121, 19 January 2024, <https://doi.org/10.1073/pnas.2310998121>

#### 4. Op-eds

1. Rothman, D. H., “Earth has seen five mass extinction events. What can we learn from them?” Guardian, 10 November 2021.

#### 5. Proceedings of Refereed Conferences

1. Rothman, D. H., “Lattice-gas automata for immiscible two-phase flow,” in *Discrete Kinetic Theory, Lattice-Gas Dynamics, and Foundations of Hydrodynamics*, R. Monaco, ed., 286-299 (World Scientific, Singapore, 1989).
2. Boghosian, B., Taylor, W., and Rothman, D. H., “A cellular-automata simulation of two-phase flow on the CM-2 Connection Machine computer,” Proceedings of *Supercomputing '88, 2: Science and Applications*, J. L. Martin and S. S. Lundstrom, eds, IEEE Computer Society Press, 34-44, 1989.
3. Rothman, D. H., “Discrete numerical models of immiscible fluids” Proceedings of the *Vth International Symposium on Numerical Methods in Engineering*, R. Gruber, J. Periaux, and R.P. Shaw, eds., 267-272, Springer-Verlag, 1989.
4. Rothman, D. H., “Immiscible lattice gases: new results, new models,” in *Cellular automata and the modeling of complex physical systems*, P. Manneville, N. Boccara, B. Vichniac, and R. Bidaux, eds., 232-238, Springer-Verlag, 1989.
5. Rothman, D. H., “Simple models of complex fluids,” in *Microscopic simulations of complex hydrodynamics*, M. Mareschal and B. Holian, eds., 221-238, Plenum Press, 1992.
6. Appert, C., Melayah, A., Pot, V., Rothman, D. H., and Zaleski, S., “Simulating evaporation in porous media with the lattice-gas method,” in *Computational methods in water resources IX, vol 2: Mathematical modeling in water resources*, T.F. Russel, R.E. Ewing, C.A. Brebbia, W.G. Gray, and G.F. Pinder, eds., 409-416, Computational Mechanics Publications, Boston, 1992.
7. Rothman, D. H. and Grotzinger, J., “Thickness statistics of sedimentary layers generated by gravity-driven flows,” in *Reduction and Predictability of Natural Disasters*, J. Rundle, B. Kellin, and D. Turcotte, eds., 1995, 117–131. (Reprint, under a different title, of publication 28.)