

Robert D. Deegan
University of Michigan
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Current position

Associate Professor, Department of Physics

Past Appointments

Associate Professor, Center for the Study of Complex Systems, University of Michigan (09/13 – 12/19)
Associate Professor, Department of Mathematics, University of Michigan (09/13 – 12/19)
Visiting Professor, Hebrew University (01/14 – 04/14)
Assistant Professor Department of Physics & the Center for the Study of Complex Systems, University of Michigan (09/07 – 08/13)
Lecturer, Department of Mathematics, University of Bristol (06/04 – 08/07)
Research Associate, Department of Physics, University of Texas – Austin (09/01 – 05/04)
Postdoctoral Fellow, Department of Physics, University of Texas – Austin (11/98 – 08/01)
Research Assistant, Department of Physics, University of Chicago (06/93 – 11/98)
Teaching Assistant, Department of Physics, University of Chicago (09/92 – 06/93)
Intern, Argonne National Laboratory (01/92 – 06/92)
Summer Fellow, Woods Hole Oceanographic Institution (06/91 – 08/91)

Education

Ph.D., University of Chicago, Physics (1998)
M.S., University of Chicago, Physics (1996)
B.S., University of Massachusetts – Amherst, Physics (1991)

Publications

R.D. Deegan, "Climbing a slippery slope", *Journal of Fluid Mechanics* **882**, F1 (2020)
S. Alben, A.A. Gorodetsky, D. Kim, R.D. Deegan, "Semi-implicit methods for the dynamics of elastic sheets", *Journal of Computational Physics* **399**, 108952 (2019)
I. Levin, R.D. Deegan, E. Sharon, "Self-powered shape-transforming membranes: an active matter approach to soft robotics", *arXiv*: 1906.00386 (2019)
C. Palma and R.D. Deegan, "Droplet Translation Actuated by Photoelectrowetting", *Langmuir* **34**, 3177 (2018)
S. Weiss, R.D. Deegan, "Weakly and strongly coupled Belousov-Zhabotinsky patterns", *Physics Review E* **95**, 022215 (2017)
X. Du, R.D. Deegan, "Ring formation on an inclined surface", *Journal of Fluid Mechanics* **775**, R3 (2015)
S. Weiss, R.D. Deegan, "Quantized orbits in the Belousov-Zhabotinsky reaction", *Europhysics Letter* **110**, 60004 (2015)
C. Palma, R.D. Deegan, "Electrowetting on semiconductors", *Applied Physics Letters* **106**, 014106 (2015)
G. Agbaglah, M.-J. Thoraval, S.T. Thoroddsen, L.V. Zhang, K. Fezzaa, R.D. Deegan, "Drop impact into a deep pool: vortex shedding and jet formation", *Journal of Fluid Mechanics*, **764**, R1 (2015)
G. Agbaglah, R.D. Deegan, "Growth and instability of the liquid rim in the crown splash regime", *Journal of Fluid Mechanics* **752** 485 (2014)
L.V. Zhang, J. Toole, K. Fezzaa, R.D. Deegan, "Splashing from drop impact into a deep pool: multiplicity of jets and the failure of conventional scaling", *Journal of Fluid Mechanics* **703**, 402 (2012)
C. Falcon, J. Bruggemann, M. Pasquali, R.D. Deegan, "Localized Structures in Vibrated Emulsions", *Europhysics Letters* **98**, 24002 (2012)

- R.D. Deegan, “Finessing the fracture energy barrier in ballistic seed dispersal”, *Proceeding of the National Academy of Science* **20**, 5166 (2012)
- L. V. Zhang, J. Toole, K. Fezzaa, R.D. Deegan, “Evolution of the ejecta sheet from the impact of a drop with a deep pool”, *Journal of Fluid Mechanics* **690**, 5 (2012)
- L.V. Zhang, P. Brunet, J. Eggers, R.D. Deegan, “Wavelength selection in the crown splash”, *Physics of Fluids* **22**, 122105 (2010)
- T. Epstein, R.D. Deegan, “Strip waves in vibrated worm-like micellar solutions”, *Physical Review E* **81**, 066310 (2010)
- R.D. Deegan, “Stress hysteresis as the cause of persistent holes in particulate suspensions”, *Physical Review E* **81**, 036319 (2010)
- P. Brunet, J. Eggers, R.D. Deegan, “Motion of a drop driven by substrate vibrations”, *European Physical Journal Special Topics* **166**, 11 (2009)
- R.D. Deegan, P. Brunet, J. Eggers, “Complexities of splashing”, *Nonlinearity* **21**, C1–C11 (2008)
- P. Brunet, J. Eggers, R.D. Deegan, “Vibration-induced climbing drops”, *Physical Review Letters* **99**, 144501 (2007)
- M. Marder, R.D. Deegan, E. Sharon, “Crumpling, buckling, and cracking: Elasticity of thin sheets”, *Physics Today* **60**, 33 (2007)
- P. Petersan, R.D. Deegan, M. Marder, H. L. Swinney, “Cracks in rubber under tension exceed the shear wave speed”, *Physical Review Letters* **93**, 015504 (2004)
- F. Merkt, R.D. Deegan, D. Goldman, E. Rericha, H.L. Swinney, “Persistent holes in a fluid”, *Physical Review Letters* **92**, 184501 (2004)
- R.D. Deegan, S. Chheda, L. Patel, M. Marder, H.L. Swinney, J.-h. Kim, A. de Lozanne, “Wavy and rough cracks in silicon”, *Physical Review E* **67**, 66209 (2003)
- R.D. Deegan, P. Petersan, M. Marder, H. L. Swinney, “Oscillating fracture paths in rubber”, *Physical Review Letters* **88**, 14304 (2002)
- R.D. Deegan, O. Bakajin, T.F. Dupont, G. Huber, S.R. Nagel, T.A. Witten, “Contact line deposits in an evaporating drop”, *Physical Review E* **62**, 756 (2000)
- R.D. Deegan, “Pattern formation in drying drops”, *Physical Review E* **61**, 475 (2000)
- R.D. Deegan, R.L. Leheny, N. Menon, S.R. Nagel, D.C. Venerus, “Dynamic shear modulus of tricresyl phosphate and squalene”, *Journal of Physical Chemistry B* **103**, 4066 (1999)
- R.D. Deegan, O. Bakajin, T.F. Dupont, G. Huber, S.R. Nagel, T.A. Witten, “Capillary flow as the cause of ring stains from dried liquid drops”, *Nature* **389**, 6653 (1997)
- R.D. Deegan, S.R. Nagel, “Dielectric susceptibility measurements of the primary and secondary relaxation in polybutadiene”, *Physical Review B* **52**, 5653 (1995)

Invited Talks

- Physics Colloquium, University of Michigan, Oct 2018
- ESAM colloquium, Northwester University, April 2018
- Physics colloquium, Oakland University, February 2017
- Fluids seminar, Brown University, December 2016
- Soft matter school, University of Massachusetts – Amherst, May 2016
- Soft matter seminar, University of Amsterdam, October 2015
- Keynote speaker, Droplets 2015, University of Twente, October 2015
- Applied & Interdisciplinary Math Seminar, University of Michigan, September 2014
- Soft matter seminar, Tel Aviv University, April 2014
- Physics colloquium, Hebrew University, February 2014
- Mathematics of Splashing, Edinburgh, May 2013
- Physics colloquium, University of Michigan, October 2012
- Levich Institute seminar, City College of New York, September 2012

SIAM conference on Nonlinear Waves and Coherent Structures, Seattle, June 2012
Nonlinear Dynamics Seminar, Georgia Institute of Technology, March 2012
Applied Math Seminar, University of Toronto, March 2012
Mechanical Engineering Seminar, University of Illinois - Chicago, January 2012
Physics colloquium, Bowling Green University, October 2011
Applied Math Seminar, University of Michigan, September 2011
Physics colloquium, Hebrew University, April 2011
Physics colloquium, University of Toledo, November 2010
Applied Math Lab Seminar, NYU, October 2010
Droplet Splashing: Fundamentals & Materials Processing, Chicago, June 2010
Capillary Shaping of Solutes, Lorentz Center, May 2010
Condensed Matter Seminar, Wayne State University, October 2009
Flowing Complex Fluids, Institute for Mathematics and its Applications, September 2009
DTU Summer School, Denmark, August 2009
International Fine Particles Research Institute, Ann Arbor, July 2009
Physics colloquium, Oakland University, March 2009
Complex Fluids Seminar, University of Michigan, November 2008
Biocomplexity Seminar, Niels Bohr Institute, November 2008
Physics Colloquium, Denmark Technical University, November 2008
Fluid Dynamics Seminar, Denmark Technical University, November 2008
Physics Colloquium, Western Ontario University, November 2008
SidFest, University of Chicago, September 2008
Computation in Physics Seminar, University of Chicago, July 2008
Geometrical Singularities and Singular Geometries Program, Institute for Mathematics and its Applications, July 2008
CSCS seminar, University of Michigan, Feb 2007
Physics Colloquium, Worcester Polytechnic Institute, Feb. 2007
Physics Colloquium, James Madison University, Jan. 2007
Fluid Dynamics Research Centre Seminar, University of Warwick, Jan. 2006
Nonlinearity Editorial Board Meeting, Sept. 2005
Multiscale nature of spark precursors and high-altitude lightning workshop, Lorentz Center, May 2005
Nonlinear and Liquid Crystal Physics Seminar, Univ. of Manchester, May 2005
DAMTP Seminar, Cambridge University, Feb. 2005.
TICAM Seminar, Cornell University, Feb. 2004.
Levich Institute Seminar, CUNY, Feb. 2004.
Applied Maths Seminar, University of Bristol, Jan. 2004.
Physics Colloquium, George Mason Univ., May 2003.
Physics Colloquium, Emory University, April 2003.
Physics Colloquium, Georgia Institute of Technology, March 2003.
Condensed Matter Seminar, Michigan State University, Feb. 2003.
Physics Colloquium, Rochester Institute of Technology, Feb. 2003.
Aspen Institute of Physics, June 1999.
Center for Nonlinear Dynamics Seminar, University of Texas at Austin, Feb. 1999.
Seminar, Rowland Institute, Boston, MA, May 1998.
Center for Nonlinear Dynamics Seminar, University of Texas at Austin, April 1998.
Physics Seminar, Univ. of Pennsylvania, March 1998.

Physics Seminar, Drexel University, March 1998.
Physics Seminar, University of Virginia, Feb. 1998.
American Physical Society March Meeting, St. Louis, March 1997.

Contributed Talks

APS: Division of Fluid Mechanics meeting, 2015.
APS: Division of Fluid Mechanics meeting, 2011.
APS: Division of Fluid Mechanics meeting, 2008.
APS: Division of Fluid Mechanics meeting, 2006.
Recent Advances in Nonlinear Dynamics, Aberdeen, Aug. 2005.
GRC: Nonlinear Science, June 2005.
Dynamics Days 2003, December 2003.
APS March meeting, 2005.
APS March meeting, 2003.
39th Annual Technical Meeting of SES, 2002.
APS March meeting, March 1996.

Current Research Support

NSF, "Towards a model for splashing: An experimental program to analyze a splash in terms of its jets", PI: Robert Deegan (\$299,998; 7/18 - 7/21)
Michigan Center for Computational Discovery and Engineering, "Teaching autonomous soft machines to swim", PIs: Silas Alben, Robert Deegan, Alex Gorodetsky (\$90,000; 5/18-4/19)
United States – Israel Binational Science Foundation, "Self-oscillating non-Euclidean sheets as prototypes of soft machines", co-PIs: Robert Deegan & Eran Sharon (€200,000; 9/15 - 8/19).
Associate Professor Fund, "Autonomous soft machines", (\$100,000; 7/17 – 6/20).

Past Research Support

DARPA, "A microfluidic platform actuated with light", PI: Robert Deegan (\$289,949; 07/12 - 07/15).
James S. McDonnell Foundation, "Interacting Patterns", PI: Robert Deegan (\$446,545; 01/09 – 04/14).
NSF, "A New Stress Bearing Mechanism in Non-Newtonian Fluids", PI: Robert Deegan (\$301,999; 10/09 - 09/13).
DOE, Advanced Photon Source, "Phase-contrast imaging of the crown splash", PI: Robert Deegan (27 shifts beam time; 06/11).
DOE, Advanced Photon Source, "Phase-contrast imaging of the crown splash", PI: Robert Deegan (9 shifts beam time; 03/11)
Royal Society, "Twinkling exponents", PI: Robert Deegan (£15,000; 09/05 - 08/06)
European Commission, "Cracks and Sparks", PI: Robert Deegan (€80,000, 06/05 - 05/07)

University Service

Department Advisor (2019/2020)
Transfer Credit Evaluator (2019/2020)
Concerns/Curriculum Committee (2014/2015, 2015/2016, 2016/2017, 2017/2018, 2019/2020)
Physics department Graduate Exam Committee (2013/2014, 2017/2018, 2019/2020)

Tenure Review Panel for Xiaoming Mao (2018/2019)
Physics Graduate Admissions and Fellowships Committee (2012/2013, 2018/2019)
Honors Senior Thesis Reader & Williams Award (2018/2019)
Commencement Marshall (Winter 2008, Winter 2010, Winter 2017, Fall 2017)

Complex Systems/Biophysics Hiring Committee (2016-2017)
Physics Department Executive Committee (2015-2017)
Awards Committee (2016/2017)
Society of Physics Students faculty advisor (2014/2015, 2015/2016)
Concentration counsellor (Fall 2010, 2011/2012, 2014/2015)
Complex Systems Hiring Committee (2013/2014, 2014/2015, 2015/2016, 2016/2017)
Physics department Graduate Exam Committee (2013/2014)
Physics Graduate Admissions and Fellowships Committee (2012/2013)
Graduate student Mini-colloquium (Winter 2009, 2011/2012)
Information Technology Committee (Fall 2010)
Advanced Lab Committee (2009/2010)
Complex Systems/Biological Physics seminar (2009/2010)
Honors Senior Thesis Reader (Winter 2010)
Introductory Physics Committee (Fall 2009)
Ad-hoc Instrumentation Shop committee (Winter 2009)
Introductory Physics Committee (Winter 2009)
Junior Faculty Lunch Organizer (2008/2009)
Complex Systems Seminar (2007/2008)
Physics Graduate Admissions Committee (2007/2008)

External Service

American Chemical Society – Petroleum Research Fund, External referee
NSF Panel review (01/10, 04/16)
Referee: Applied Physics Letters, European Physical Journal E, Experiments in Fluids, Journal of Colloidal and Interface Science, Journal of Fluid Mechanics, Langmuir, Nature, Physical Review Letters, Physical Review E, Physics of Fluids, Physics Letters A, Plant Sciences.
Dutch Technology Foundation, External referee

Symposia and Conferences Organized

2019 Nobel Symposium, University of Michigan (12/2019)
The Origin of Life, University of Michigan ICAM, 2013
Emergence in Physical, Biological, & Social Systems IV, University of Michigan ICAM, 2009

Outreach

Wolverine Pathways, Ypsilanti High School (Fall 2016)
Saturday morning physics lecture, University of Michigan (4/13)
Expedition Series workshop (Subtle Technologies, 03/12)
Mentored high school student for the Northern Michigan Science Symposium (2009)
Organized Museum Exhibit workshop (05/09)
Science Olympiad Coach (2008)

Graduate students supervised

University of Michigan
Grace Cai (Winter 2019)
Masoumeh Gharaati (visiting student from Iran)
Cesar Palma (2013 – 2017) – graduated with PhD
Xiyu Du (2012 – 2013)
Li Zhang (2009 – 2012) – graduated with PhD
Laura Colon-Melendez (2009 – 2010)
Michelle Adan (2008 – 2010)

University of Bristol

Anthony Allen (2006 – 2007) – graduated with MSci.
Alice Hooker-Stroud (2006 – 2007) – graduated with MSci.
Jonathan Maitipe (2006 – 2007) – graduated with MSci.
Charlotte Mckenzie (2006 – 2007) – graduated with MSci.
James Solano (2006 – 2007) – graduated with MSci.
Bethan White (2006 – 2007) – graduated with MSci.
James Brown (2005 – 2006) – graduated with MSci.
Stephen McCartney (2005 – 2006) – graduated with MSci.
Martyn Hancock (2004 – 2005) – graduated with MSci.

Doctoral committee service

Brandon Berg (member)
Paige Martin (member)
Orion Sauter (member)
Leyou Zhou (member)
Siddhant Agrawal (member)
Hai Zhu (co-chair, Applied Math)
Christopher Miles (member)
Cesar Palma (chair)
Andrew Morten (member)
Hengxi Yang (co-chair)
Brian Karrer (member)
Tony Lloyd Smith (member)

Postdoctoral fellows supervised

Ruoyang Chen (2/20 – Present)
Aaron True (9/2019 – Present)
Stephan Weiss (5/2012 – 7/2015) – now Principle Investigator, Max Planck Institute for Dynamics and Self-Organisation, Göttingen, Germany
Gilou Agbaglah (9/2012 – 9/2014) – now Assistant Professor at Wayne State University
Claudio Falcon (2011 – 2012) – now Assistant Professor at Universidad de Chile
Tamir Epstein (2008 – 2009) – now Postdoctoral Researcher at Moffit Cancer Center
Philippe Brunet (2006 – 2007) – now Chargé de Recherche in CNRS .

Undergraduate students supervised

University of Michigan

Ang Li (Fall 2019 – present)
Jacob Solomon (Fall 2019 – present)
Conor McQuiston (Fall 2019 – present)
Zhuoheng Yang (Fall 2019)
Joshua Kooistra (Fall 2017 – Winter 2019)
Thomas Rometsch (Winter 2015 – Summer 2015)
Alan Phillips (Winter 2015)
Pavel Okun (Fall 2014 – Summer 2015)
Max Brodsky (Summer & Fall 2014)
Quinn Macpherson (REU summer student 2013)
Sejay Tan (Winter and Summer terms 2012)
Sean Carney (Winter and Summer terms 2012)
Zach Pomerantz (2011 – 2012)
Emily Lichko (UROP student 2010 – 2011)

Sammit Nene (UROP student 2010 – 2011)
Jake Bruggemann (REU summer student 2010)
Frank Sedlar (UROP student 2009 – 2010)
Yun Suk Eo (Senior Thesis 2009 – 2010)
Jameson Toole (Senior Thesis 2008 – 2010)
William Turner (2007 – 2008)

University of Bristol

Anthony Allen, (honours project 2006 – 2007)
Alice Hooker-Stroud (honours project 2006 – 2007)
Jonathan Maitipe (honours project 2006 – 2007)
Charlotte Mckenzie (honours project 2006 – 2007)
James Solano (honours project 2006 – 2007)
Bethan White (honours project 2006 – 2007)
James Brown (honours project 2005 – 2006)
Stephen McCartney (honours project 2005 – 2006)
Chris Bromley (honours project 2004 – 2005)
Martyn Hancock (honours project 2004 – 2005)
James Perrot (honours project 2004 – 2005)

Teaching

University of Michigan

CMPLXSYS 270: Agent-based modelling, Fall 2019
PHYS 106: Everyday physics, Winter 2019
PHYS 360: Honors Physics III, Winter 2016, 2017, 2018
CMPLXSYS 541 /PHYS 413: *Introduction to Nonlinear Dynamics and the Physics of Complexity*, Fall 2014, 2015, 2016, 2017
PHYS 452: *Methods of Theoretical Physics II*, Winter 2015
MATH 404: *Intermediate Differential equations*, Fall 2014, 2015, 2016, 2017
PHYS 406: *Thermal Physics*, Winter & Fall 2013
PHYS 401: *Classical Mechanics*, Winter 2009, 2011, 2012
CMPLXSYS470 /PHYS 470: *Experiments in Non-linear Dynamics*, Fall 2009, 2010, 2011, 2012
PHYS 235: *Physics for the Life Sciences II* (discussion sections), Winter 2008

University of Bristol

Calculus & Mechanics tutorials, 2004 – 2005, 2005 – 2006, 2006 – 2007
Math 11200: *Mechanics 1B*, Spring 2005, Spring 2006, Spring 2007

Awards & Fellowships

Lady Davis Fellowship (2014)
Harold C. Early Award (2009)
CRLT Faculty Development Fund, “A Laboratory Course in Nonlinear Science” (2008)
Undergraduate Fellowship, Woods Hole Oceanographic Institution (1991)