

## Curriculum Vitae

**Joshua W. Shaevitz**

Professor of Physics and Genomics

Princeton University

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### CONTACT INFORMATION

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### PROFESSIONAL EXPERIENCE

**Princeton University**, Princeton, NJ ..... 2017–present  
*Professor*, Department of Physics and Lewis-Sigler Institute for Integrative Genomics

**Princeton University**, Princeton, NJ ..... 2013–2017  
*Associate Professor*, Department of Physics and Lewis-Sigler Institute for Integrative Genomics

**Princeton University**, Princeton, NJ ..... 2007–2013  
*Assistant Professor*, Department of Physics and Lewis-Sigler Institute for Integrative Genomics

**Howard Hughes Medical Institute**, Ashburn, VA ..... 2012–2016  
*Visiting Scientist*, Janelia Farm Research Campus

**JILA (NIST-CU)**, Boulder, CO ..... 2012  
*Distinguished Visitor*

**University of California at Berkeley**, Berkeley, CA USA ..... 2004–2007  
*Miller Research Fellow*, Miller Institute for Basic Research in Science

### EDUCATION

Ph.D. in Physics, Stanford University, Stanford, CA, ..... June 2004  
Thesis Topic: “The Biophysics Of Molecular Motors: Optical Trapping Studies Of Kinesin  
And RNA Polymerase.” Advisor: Professor Steven M. Block

M.S. in Physics, Stanford University, Stanford, CA, ..... June 2002

B.A. in Physics, Columbia University, New York, NY ..... May 1999

**HONORS AND AWARDS**

JILA (NIST-CU Boulder) Distinguished Visitor .....	2012
Presidential Early Career Award for Scientists and Engineers (PECASE) .....	2009
Pew Scholar in the Biomedical Sciences .....	2009–2013
National Science Foundation CAREER Award .....	2009–2014
Human Frontier Science Program Young Investigator Award .....	2008–2011
Sloan Research Fellowship .....	2008–2010
Miller Institute for Basic Research in Science Postdoctoral Fellowship .....	2004–2007
First International Nanoscale/Molecular Mechanics Conference Travel Grant .....	2002
Physics Department Alfred Moritz Michaelis Award, Columbia University .....	1999
I. I. Rabi Scholarship, Columbia University .....	1995–1999

**SERVICE**

Co-Director, NSF Physics Frontier Center for the Physics of Biological Function ...	2017–present
Council of the Princeton University Community (CPUC) .....	2017–2020
CPUC Executive Committee and Faculty Advisory Committee on Policy (FACP) ..	2017–present
University Librarian Search Committee .....	2015–2016
Director of Graduate Studies, Graduate Program in QCB .....	2014–2018
Integrated Science Program Director .....	2012–present
Graduate School Fellowship Committee .....	2016–2017
Graduate School Student Life and Discipline Committee .....	2014–2015
Junior Paper Committee Chair, Physics Department .....	2013–2014
Executive Committee for the Lewis-Sigler Institute .....	2012–present
Freshman and Sophomore Academic Advisor for Rockefeller College .....	2010–present
Graduate Program in QCB Admissions Committee .....	2009–present
Executive Committee for the Graduate Program in QCB .....	2008–present
Lewis-Sigler Fellow Search Committee Chair .....	2008–2017
Biophysics Seminar Series Organizer .....	2009–2010
Physics Department Graduate Admissions Committee .....	2008–2013
Physics Department Experimental Project Orals Examiner .....	2008–2009, 2013–2014
Physical Review Letters Divisional Associate Editor .....	2017–2020
HFSP Career Development Award Selection Committee .....	2017–2019
American Physical Society Division of Biological Physics (DBIO) Member at Large ...	2013–2016
Pew Scholars Alumni Nomination Review Panel .....	2013–present

**TEACHING AND ADVISING**

FRS147 The Science of Mythbusters .....	2016
ISC231–234 An Integrated, Quantitative Introduction to the Natural Sciences .....	2008–present
PHY412 Biological Physics .....	2008–2014, 2017
MOL515 Guest lecturer, Method and Logic in Quantitative Biology .....	2009
Guest lecturer in several classes at UC Berkeley .....	2004–2007

PhD theses: Siyuan Wang (2011), Yi Deng (2012), Jeffrey Nguyen (2015), Nikolay Ouzounov (2015), Daniel Choi (2016), Andrew Hartnett (2017), Ashley Linder (2017), Ugne Klibaite (2018)

Current PhD students:

Matthew Black, Guannan Liu, Mochi Liu, Grace McKenzie-Smith, Diana Valverde Mendez, Talmo Pereira, Sagar Setru, Cassidy Yang

Current postdoctoral fellows:

Benjamin Bratton, Ugne Klibaite, Matthias Koch, Katherine Copenhagen, Muhammad Junaid Amin

Former postdoctoral fellows with academic positions:

Mingzhai Sun (University of Science and Technology of China), Teuta Pilizota (University of Edinburgh), Sven van Teeffellen (Institut Pasteur), Shashi Thutupalli (National Center for Biological Sciences; International Center for Theoretical Sciences at the Tata Institute of Fundamental Research, Bangalore, India; and Max Planck India), Gordon Berman (Emory University), Akeisha Belgrave (Harrisburg University of Science and Technology)

Lewis-Sigler postdoctoral fellows mentored with academic positions:

Tessa Calhoun (University of Tennessee), Andrew Leifer (Princeton University)

**PUBLICATIONS**

1. Guannan Liu, Adam Patch, Fatmagul Bahar, David Yllanes, Roy D. Welch, M. Cristina Marchetti, Shashi Thutupalli, **Joshua W. Shaevitz**. Self-driven phase transition drives *Myxococcus xanthus* fruiting body formation. *PRL* (in press), arXiv:1709.06012, 2019.
2. Akanksha Thawani, Howard A Stone , **Joshua W. Shaevitz**, Sabine Petry. Spatiotemporal organization of branched microtubule networks. *eLife*, doi: 10.7554/eLife.43890, 2019.
3. Talmo Pereira, Diego Aldarondo, Lindsay Willmore, Mikhail Kislin, Samuel S. Wang, Mala Murthy, **Joshua W. Shaevitz**. Fast animal pose estimation using deep neural networks. *Nature Methods*, doi:10.1038/s41592-018-0234-5, bioRxiv: 331181, 2019.
4. **Joshua W. Shaevitz**. Microbiology: Peeling Back the Layers of Bacterial Envelope Mechanics. *Current Biology*, doi:10.1016/j.cub.2018.09.023, 2018.
5. M. Guzzo, S.M. Murray, E. Martineau, S. Lhospice, G. Baronian, L. My, Y. Zhang, L. Espinosa, R. Vincentelli, B.P. Bratton, **Joshua W. Shaevitz**, V. Molle, M. Howard, T. Mignot. A gated relaxation oscillator mediated by FrzX controls morphogenetic movements in *Myxococcus xanthus*. *Nature Microbiology*, doi: 10.1038/s41564-018-0203-x, 2018.
6. Mochi Liu, Anuj K Sharma, **Joshua W Shaevitz**, Andrew M Leifer. Temporal processing and context dependency in *C. elegans* mechanosensation. *eLife* 10.7554/eLife.36419, arXiv:1803.04085, 2018.
7. Benjamin P Bratton, **Joshua W Shaevitz**, Zemer Gitai, Randy M Morgenstein. MreB polymers and curvature localization are enhanced by RodZ and predict *E. coli*'s cylindrical uniformity. *Nature Communications* doi:10.1038/s41467-018-05186-5, bioRxiv: 226290, 2018.
8. Jessica Cande, Gordon J Berman, Shigehiro Namiki, Wyatt Korff, Gwyneth Card, **Joshua W Shaevitz**, David L Stern. Optogenetic dissection of descending behavioral control in *Drosophila*. *eLife* doi:10.7554/eLife.34275, bioRxiv: 230128, 2018.
9. George Liu, Benjamin Bratton, Zemer Gitai, **Joshua W Shaevitz**. The effect of antibiotics on protein diffusion in the *Escherichia coli* cytoplasmic membrane. *PLoS ONE* doi: 10.1371/journal.pone.0185810, 2017.
10. Mathilde Guzzo, Sen M. Murray, Eugnie Martineau, Sbastien Lhospice, Grgory Baronian, Laetitia My, Yong Zhang, Leon Espinosa, Renaud Vincentelli, Benjamin P. Bratton, **Joshua W. Shaevitz**, Virginie Molle, Martin Howard, Tm Mignot. A gated relaxation oscillator controls morphogenetic movements in bacteria. *Nature Microbiology* (in press), bioRxiv: 137695, 2017.
11. Benedikt Sabass, Matthias D. Koch, Guannan Liu, Howard A. Stone, and **Joshua W. Shaevitz**. Force generation by groups of migrating bacteria. *PNAS* doi: 10.1073/pnas.1621469114, arXiv:1701.00524, 2017.
12. Jeffrey P. Nguyen, Ashley N. Linder, George S. Plummer, **Joshua W. Shaevitz**, Andrew M. Leifer. Automatically tracking neurons in a moving and deforming brain. *PLoS Comput Biol* doi: 10.1371/journal.pcbi.1005517, arXiv:1610.04579, 2017.

13. Ugne Klibaite, Gordon J Berman, Jessica Cande, David L Stern, **Joshua W Shaevitz**. An Unsupervised Method of Quantifying Courtship Behavior in Drosophila. *Physical Biology* doi:10.1088/1478-3975/aa5c50, arXiv:1609.09345, 2017.
14. Thomas Bartlett, Benjamin Bratton, A Duvshani, Amanda Miguel, Y Sheng, NR Martin, Jeffrey Nguyen, Alex Persat, SM Desmarais, MS VanNieuwenhze, Kerwyn Casey Huang, **Joshua W Shaevitz**, Zemer Gitai. A Periplasmic Polymer Curves Vibrio cholerae and Promotes Pathogenesis. *Cell* doi: 10.1016/j.cell.2016.12.019, 2017.
15. Gordon J Berman, William Bialek, **Joshua W Shaevitz**. Predictability and hierarchy in Drosophila behavior. *PNAS* doi:10.1073/pnas.1607601113, arXiv:1605.03626, 2016.
16. Nikolay Ouzounov, Jeffrey Nguyen, Benjamin Bratton, David Jacobowitz, Zemer Gitai, **Joshua W Shaevitz**. MreB helical pitch angle determines cell diameter in Escherichia coli. *Biophysical Journal* doi:10.1016/j.bpj.2016.07.017, arXiv:1503.07789, 2016.
17. Qingqing Wang, J Matthew Taliaferro, Ugne Klibaite, Valerie Hilgers, **Joshua W Shaevitz**, Donald R Rio. The PSI-U1 snRNP interaction regulates male mating behavior in Drosophila *Proceedings of the National Academy of Sciences* doi: 10.1073/pnas.1600936113, 2016.
18. Jeffrey Nguyen, Fred Shipley, Ashley Linder, George Plummer, **Joshua W Shaevitz**, Andrew Leifer. Whole-brain calcium imaging with cellular resolution in freely behaving C. elegans. *Proceedings of the National Academy of Sciences* doi:10.1073/pnas.1507110112, 2015.
19. Randy Morgenstein, Benjamin Bratton, Jeffrey Nguyen, Nikolay Ouzounov, **Joshua W Shaevitz**, Zemer Gitai. The mechanism and function of MreB rotation: RodZ is a linker that mediates robust growth. *Proceedings of the National Academy of Sciences* doi:10.1073/pnas.1509610112, 2015.
20. Benjamin Bratton, **Joshua W Shaevitz**. Simple Experimental Methods for Determining the Apparent Focal Shift in a Microscope System. *PLoS One* doi:10.1371/journal.pone.0134616, 2015.
21. Shashi Thutupalli, Mingzhai Sun, Filiz Bunyak, K Palaniappan, **Joshua W Shaevitz**. Directional reversals enable Myxococcus xanthus cells to produce collective one-dimensional streams during fruiting body formation. *Journal of the Royal Society Interface* doi:10.1098/rsif.2015.0049, 2015.
22. Gordon J Berman, Daniel M Choi, William Bialek, **Joshua W Shaevitz**. Mapping the stereotyped behaviour of freely-moving fruit flies. *Journal of the Royal Society Interface* doi:10.1098/rsif.2014.0672, 2014.
23. Teuta Pilizota, **Joshua W Shaevitz**. Origins of E. coli growth rate and cell shape changes at high external osmolality. *Biophysical Journal* doi:10.1016/j.bpj.2014.08.025, 2014.
24. Oleg Polyakov, Bing He, Michael Swan, **Joshua W Shaevitz**, Matthias Kaschube, Eric Wieschaus. Passive Mechanical Forces Control Cell Shape Change during Drosophila Ventral Furrow Formation. *Biophysical Journal* doi:10.1016/j.bpj.2014.07.013, 2014.
25. Gabriel Billings, Nikolay Ouzounov, Tristan S Ursell, Samantha M Desmarais, **Joshua W Shaevitz**, Zemer Gitai, Kerwyn Casey Huang. De novo morphogenesis in L-forms via geometric control of cell growth. *Molecular Microbiology* doi: 10.1111/mmi.12703, 2014.

26. Rajesh Balagam, Douglas B Litwin, Fabian Czerwinski, Mingzhai Sun, Heidi B Kaplan, **Joshua W Shaevitz**, Oleg A Igoshin Myxococcus xanthus Gliding Motors Are Elastically Coupled to the Substrate as Predicted by the Focal Adhesion Model of Gliding Motility. *PLoS Computational Biology* doi: 10.1371/journal.pcbi.1003619, 2014.
27. Yi Deng, Mingzhai Sun, Peihui Lin, Jianjie Ma, **Joshua W Shaevitz**. Spatial Covariance Reconstructive (SCORE) Super-Resolution Fluorescence Microscopy. *PLoS One* doi: 10.1371/journal.pone.0094807, 2014.
28. Tristan S Ursell, Jeffrey Nguyen, Russell D Monds, Alexandre Colavin, Gabriel Billings, Nikolai Ouzounov, Zemer Gitai, **Joshua W Shaevitz**, Kerwyn Casey Huang. Rod-like bacterial shape is maintained by feedback between cell curvature and cytoskeletal localization. *Proceedings of the National Academy of Sciences* doi:10.1073/pnas.1317174111, 2014.
29. Fabian Czerwinski, **Joshua W Shaevitz**. The biophysics of *Myxococcus xanthus* motility. In Zhaomin Yang and Penelope I Higgs (Eds.), *Myxobacteria: Genomics, Cellular and Molecular Biology* Caister Academic Press, 2014.
30. Wartel, Ducret, Thutupalli, Czerwinski, Le Gall, Mauriello, Bergham, Brun, **Joshua W Shaevitz**, Mignot. A versatile class of cell surface directional motors gives rise to gliding motility and sporulation in *Myxococcus xanthus*. *PLoS Biology* doi:10.1371/journal.pbio.1001728, 2013.
31. **Joshua W Shaevitz**. Combining Modeling and Experiment to Understand Bacterial Growth. *Biophysical Journal* doi:10.1016/j.bpj.2013.05.007, 2013.
32. Yi Deng, Pip Coen, Mingzhai Sun, **Joshua W Shaevitz**. Efficient Multiple Object Tracking Using Mutually Repulsive Active Membranes. *PLoS ONE* doi:10.1371/journal.pone.0065769, 2013.
33. Teuta Pilizota, **Joshua W Shaevitz**. Plasmolysis and cell shape depend on solute outer-membrane permeability during hyperosmotic shock in *E. coli*. *Biophysical Journal* doi:10.1016/j.bpj.2013.05.011, 2013.
34. David Borenstein, Yigal Meir, **Joshua W Shaevitz**, Ned Wingreen. Non-local interaction via diffusible resource prevents coexistence of cooperators and cheaters in a lattice model. *PLoS One*, doi:10.1371/journal.pone.0063304, 2103.
35. Siyuan Wang and **Joshua W Shaevitz**. The mechanics of shape in prokaryotes. *Frontiers in Bioscience*, doi:10.2741/S390, 2013, 2013.
36. Kerwyn Casey Huang, David W. Ehrhardt, **Joshua W. Shaevitz** The molecular origins of chiral growth in walled cells *Current Opinions in Microbiology*, doi:10.1016/j.mib.2012.11.002, 2012.
37. Teuta Pilizota, **Joshua W Shaevitz**. Fast, Multiphase Volume Adaptation to Hyperosmotic Shock by *Escherichia coli*. *PLoS One* 7, e35205, 2012.
38. Siyuan Wang, Leon Furchgott, Kerwyn Casey Huang, and **Joshua W Shaevitz**. Helical insertion of peptidoglycan produces elongation and chiral ordering of the bacterial cell wall. *Proceedings of the National Academy of Sciences* 107(10):E595-E604, 2012
39. Sven van Teeffelen, **Joshua W Shaevitz**, Zemer Gitai. Image analysis in fluorescence microscopy: Bacterial dynamics as a case study *BioEssays* 34, 427-436, 2012.

40. Yong Zhang, Adrien Ducret, **Joshua W Shaevitz**, Tâm Mignot. From individual cell motility to collective behaviors: insights from a prokaryote, *Myxococcus xanthus*. *FEMS Microbiology Reviews* 36:149-164, 2012.
41. Yi Deng, Mingzhai Sun, and **Joshua W Shaevitz**. Direct Measurement of Cell Wall Stress Stiffening and Turgor Pressure in Live Bacterial Cells. *Physical Review Letters*, 107(15):158101, 2011.
42. Sven van Teeffelen, Siyuan Wang, Leon Furchtgott, Kerwyn Casey Huang, Ned S Wingreen, **Joshua W Shaevitz**, and Zemer Gitai. The bacterial actin MreB rotates, and rotation depends on cell-wall assembly. *Proceedings of the National Academy of Sciences*, 108(38): 15822-15827, 2011.
43. Mingzhai Sun, Morgane Wartel, Eric Cascales, **Joshua W Shaevitz**, and Tâm Mignot. Motor-driven intracellular transport powers bacterial gliding motility. *Proceedings of the National Academy of Sciences*, 108(18):7559-7564, 2011.
44. Muthuvel Arigovindan, **Joshua W Shaevitz**, John McGowan, John W Sedat, and David A Agard. A parallel product-convolution approach for representing the depth varying point spread functions in 3D widefield microscopy based on principal component analysis. *Optics Express*, 18:6461-6476, 2010.
45. **Joshua W Shaevitz** and Simon Nørrelykke. The cytoskeleton: I-beams of the cell. *Physics Today*, 63(2), 2010.
46. Siyuan Wang, Hugo Arellano-Santoyo, Peter A Combs, and **Joshua W Shaevitz**. Measuring the bending stiffness of bacterial cells using an optical trap. *Journal of Visualized Experiments*, (38), 2010.
47. **Joshua W. Shaevitz** and Zemer Gitai. The structure and function of bacterial actin homologs. *Cold Spring Harbor Perspectives in Biology*, 2(9), 2010.
48. Siyuan Wang, Hugo Arellano-Santoyo, Peter A Combs, and **Joshua W Shaevitz**. Actin-like cytoskeleton filaments contribute to cell mechanics in bacteria. *Proceedings of the National Academy of Sciences*, 107(20):9182-5, 2010.
49. Yi Deng and **Joshua W Shaevitz**. Effect of aberration on height calibration in three-dimensional localization-based microscopy and particle tracking. *Applied Optics*, 48(10):1886-90, 2009.
50. **Joshua W Shaevitz**. Bayesian Estimation of the Axial Position in Astigmatism-Based Three-Dimensional Particle Tracking. *International Journal of Optics*, ID 896208, 2009.
51. Stefano Marchesini, Sebastien Boutet, Anne E Sakdinawat, Michael J Bogan, Sasa Bajt, Anton Barty, Henry N Chapman, Matthias Frank, Stefan P Hau-Riege, Abraham Szoke, Congwu Cui, David A Shapiro, Malcolm R Howells, John C H Spence, **Joshua W Shaevitz**, Joanna Y Lee, Janos Hajdu, and Marvin M Seibert. Massively parallel x-ray holography. *Nature Photonics*, 2(9):560-563, 2008.
52. **Joshua W Shaevitz**. Super-resolution for a 3D world. *Nature Methods*, 5(6):471-2, 2008.
53. **Joshua W Shaevitz** and Daniel A Fletcher. Curvature and torsion in growing actin networks. *Physical Biology*, 5(2):26006, 2008.

54. Michael J Rosenbluth, Ailey Crow, **Joshua W Shaevitz**, and Daniel A Fletcher. Slow stress propagation in adherent cells. *Biophysical Journal*, 95(12):6052-9, 2008.
55. Tãm Mignot and **Joshua W Shaevitz**. Active and passive mechanisms of intracellular transport and localization in bacteria. *Current opinion in microbiology*, 11(6):580-5, 2008.
56. Tãm Mignot, **Joshua W Shaevitz**, Patricia L Hartzell, and David R Zusman. Evidence that focal adhesion complexes power bacterial gliding motility. *Science*, 315(5813):853-6, 2007.
57. **Joshua W Shaevitz** and Daniel A Fletcher. Enhanced three-dimensional deconvolution microscopy using a measured depth-varying point-spread function. *Journal of the Optical Society of America A*, 24(9):2622-7, 2007.
58. **Joshua W Shaevitz** and Daniel A Fletcher. Load fluctuations drive actin network growth. *Proceedings of the National Academy of Sciences*, 104(40):15688-92, 2007.
59. **Joshua W Shaevitz**, Steven M Block, and Mark J Schnitzer. Statistical kinetics of macromolecular dynamics. *Biophysical Journal*, 89(4):2277-85, 2005.
60. **Joshua W Shaevitz**, Joanna Y Lee, and Daniel A Fletcher. Spiroplasma swim by a processive change in body helicity. *Cell*, 122(6):941-5, 2005.
61. Elio A Abbondanzieri, **Joshua W Shaevitz**, and Steven M Block. Picocalorimetry of transcription by RNA polymerase. *Biophysical Journal*, 89(6):L61-3, 2005.
62. Elio A Abbondanzieri, William J Greenleaf, **Joshua W Shaevitz**, Robert Landick, and Steven M Block. Direct observation of base-pair stepping by rna polymerase. *Nature*, 438(7067):460-5, 2005.
63. **Joshua W Shaevitz**, Elio A Abbondanzieri, Robert Landick, and Steven M Block. Backtracking by single rna polymerase molecules observed at near-base-pair resolution. *Nature*, 426(6967):684-7, 2003.
64. Steven M Block, Charles L Asbury, **Joshua W Shaevitz**, and Matthew J Lang. Probing the kinesin reaction cycle with a 2D optical force clamp. *Proceedings of the National Academy of Sciences*, 100(5):2351-6, 2003.
65. Matthew J Lang, Charles L Asbury, **Joshua W Shaevitz**, and Steven M Block. An automated two-dimensional optical force clamp for single molecule studies. *Biophysical Journal*, 83(1):491-501, 2002.