Alexander P.P. Petroff Assistant Professor Department of Physics Clark University 950 Main St Worcester, MA, 01610 508-793-7366 apetroff@clarku.edu https://wordpress.clarku.edu/apetroff/ June 1, 2018

Education

Ph.D. Geophysics, Massachusetts Institute of Technology, Cambridge, MA June 2011
Microbial Diversity Summer School, Woods Hole Oceanographic Institution (June–Aug 2009)
B.A. Magna cum laude, Physics, Carleton College, Northfield, MN June 2006
B.A. Magna cum laude, Mathematics, Carleton College, Northfield, MN June 2006
Summer Research Intern, Santa Fe Institute, June-Aug 2005

Appoinments

Assistant Professor, Clark University (Jan 2018–) Research Professor, Clark University (Aug–Dec 2017) Visiting Assistant Professor of Biology, Bard College (Aug–Dec 2016) Research Scientist, Rockefeller University (Sept 2015–Dec 2017) Research Fellow, Rockefeller University (Sept 2011–Aug 2015) Teaching Assistant for Modeling Environmental Complexity, Massachusetts Institute of Technology, Sept–Dec 2008 Mathematics Tutor, Carleton College, Jan 2004–June 2006

Honors

Raymond and Beverly Sackler Fellow, Rockefeller University Sept 2012-Aug 2016 John C. Whitehead Presidential Fellow, Rockefeller University Sept 2011-Aug 2012 Center for Studies in Physics and Biology Department Fellowship, Rockefeller University Sept 2011-Aug 2013 American Geophysical Union Outstanding Student Paper Award in Biogeoscience 2010

American Geophysical Union Outstanding Student Paper Award in Biogeoscience 2010 American Geophysical Union Outstanding Student Paper Award in Hydrology 2008 Department Student Teaching Award, Massachusetts Institute of Technology 2008 Linden Earth System Graduate Fellowship, Massachusetts Institute of Technology Sept 2006-Aug 2007

Graduation with Distinction in Physics, Carleton College 2006 Dean's List, Carleton College 2006

Thesis

Petroff, A.P., Streams, Stromatolites, and the Geometry of Growth. http://segovia.mit.edu/~petroffa/text/thesis.pdf

Publications

1. Petroff, AP, Tejera, F, & Libchaber, A, Dynamics of Oxygen in a Two-Dimensional Microbial Ecosystem. *Physical Review E (Submitted)*

- 2. Petroff, AP & Libchaber, A, Nucleation of Rotating crystals by *Thiovulum majus* bacteria. *New Journal of Physics* **20**, 015007 (2017)
- 3. Petroff, AP, Tejera, F, & Libchaber, A, Subsurface Microbial Ecosystems: A Photon Flux and a Metabolic Cascade. *Journal of Statistical Physics* **167**, (2017)
- 4. Petroff, AP, Pasulka, A, Soplop N, Wu, XL, & Libchaber, A, Biophysical basis for convergent evolution of two veil-forming microbes. *Royal Society Open Science* **2**, 150437 (2015)
- 5. Petroff, AP, Wu, XL, & Libchaber, A, Fast-moving bacteria self organize into active twodimensional crystals of rotating cells. *Physical Review Letters* **114**, 158102 (2015)
- 6. Petroff, AP & Libchaber, A, Hydrodynamics and collective behavior of the tethered bacterium *Thiovulum majus*. *Proceedings of the National Academy of Sciences* **5**, E537 (2014)
- 7. Petroff, AP, Beukus, N, Rothman, DH, & Bosak, T. Biofilm growth and fossil form. *Physical Review X* **3**, 041012 (2013)
- 8. Petroff, AP, Devauchelle, O, Seybold H, & Rothman DH, Bifurcation dynamics of natural drainage networks. *Philosophical Transactions of the Royal Society A* **371**, 2004 (2013)
- 9. Bosak, T, Knoll, AH, & Petroff, AP, The Meaning of Stromatolites. *Annual Review of Earth and Planetary Sciences* **41**, 21 (2013)
- 10. Sim, MS, Liang, B, Petroff, AP, Evans, A, Klepac-Ceraj, V, Flannery, D, Walter, MR, & Bosak, T, Oxygen-Dependent Morphogenesis of Modern Clumped Photosynthetic Mats and Implications for the Archean Stromatolite Record. *Geosciences* **2**, 235 (2012)
- 11. Berhanu, M, Petroff, AP, Devauchelle, O, Kudrolli, A, & Rothman, DH, Shape and dynamics of seepage erosion in a horizontal granular bed. *Physical Review E* **86**, 041304 (2012)
- 12. Devauchelle, O, Petroff, AP, Seybold H, & Rothman D.H., Ramification of Stream Networks. *Proceedings of the National Academy of Sciences* **109**, 20832 (2012)
- 13. Petroff, AP, Devauchelle, O, Kurolli A, & Rothman DH, Four bagatelles on channel growth. *Comptes Rendus Geoscience* **344**, 33 (2012)

- 14. Petroff, AP, Wu, TD, Liang, B, Mui, J, Guerquin-Kern, JL, Vali, H, Rothman, DH, & Bosak, T, Reaction-diffusion model of nutrient uptake in a biofilm: Theory and experiment. *Journal of Theoretical Biology* **289**, 90 (2011).
- 15. Petroff, AP, Devauchelle, O, Abrams, DM, Lobkovsky, A, Kudrolli, A. & Rothman, DH Geometry of valley growth. *Journal of Fluid Mechanics* **273**, 245 (2011)
- 16. Devauchelle, O, Petroff, AP, Lobkovsky, A & Rothman, DH, Longitudinal profile of channels cut by springs. *Journal of Fluid Mechanics* 667, 28 (2011)
- 17. Petroff, AP, Sim, MS, Maslov, A, Krupenin, M, Rothman, DH, & Bosak, T, Biophysical basis for the geometry of conical stromatolites. *Proceedings of the National Academy of Sciences* **107**, 9956 (2010)
- 18. Bosak, T, Bush JWM, Flynn MR, Liang, B, Ono, S, Petroff, AP, & Sim, MS, Formation and stability of oxygen-rich bubbles that shape photosynthetic mats. *Geobiology* **8**, 45 (2010).
- 19. Bosak, T, Liang, B, Sim, M & Petroff, AP, Morphological record of oxygenic photosynthesis in conical stromatolites. *Proceedings of the National Academy of Sciences* **106**, 10939 (2009)
- 20. Abrams, DM, Lobkovsky, A, Petroff, AP, Straub, K, McElroy, B, Mohrig, D, Kudrolli, A, & Rothman, D.H. Growth laws for channel networks incised by groundwater flow. *Nature Geoscience* **28**, 193 (2009)
- 21. Koontz, T, Petroff, AP, West, G, & Brown, J, Scaling relations for a functionally twodimensional plant: Chamaesyce setiloba (Euphorbiaceae). *American Journal of Botany* **96**, 877 (2009)
- 22. Mewes, M & Petroff, AP, Cavity tests of parity-odd Lorentz violations in electrodynamics. *Physical Review D* **75**, 056002 (2007).

Proceedings

 McMahon, S., Bosak, T., Grotzinger, JP., Briggs, DEG., Hurowitz, J., Tosca, N., Petroff, A., Summons, RE, Weiss, BP., How Can We Look for Fossils on Mars? *Second International Mars Sample Return* 2071 6078 (2018)

Preprints

1. Petroff, AP, Tejera, F, & Libchaber, A, Localization and Dynamics of Sulfur-Oxidizing microbes in Natural Sediment. *arXiv* 1704.08212 (2017)

Invited Presentations

- 1. 16th annual Granular Material Workshop, Yale University June 2018
- 2. Physiology Summer School, Woods Hole Oceanographic Institution, 2016
- 3. Microbial Stress Response, Gordon Research Conference, Mount Holyoke, June 2016
- 4. Marine Microbes, Gordon Research Conference, Barcelona, June 2016
- 5. Microbial Diversity Summer School, Woods Hole Oceanographic Institution, July 2015
- 6. 12th annual Frontiers in Applied and Computational Mathematics, New Jersey Institute of Technology, June 2015
- 7. Microbial Diversity Summer School, Woods Hole Oceanographic Institution, July 2014
- 8. SIAM Conference on Nonlinear Waves and Coherent Structures, Seattle, June 2012

Research Advisees

Graduate Students: Benjamin Roque (Jan 2018–) Undergraduate Students: Alejanda Rosselli Calderon (Apr 2018–), Cameron Mitchell (May 2018-)

Teaching

Courses: PHYS 121 Introductory Physics with Calculus II, Modeling Biological Complexity

Service

Clark Active Matter Group Physics Graduate Admission Committee Clark University Maker Space, Faculty Sponsor

Press

Wogan, T., *Bacteria Stick Together as Living Crystals* 2015, Physics 8,35.

Petroff, A., *Radiolab, Super Cool* 2014, Radiolab Short.

Morrison, J., *Bacteria work together to gather food* 2014, PNAS First Look Blog.

Voss, D., *Eons of Diffusive Growth* 2013, Physics.

Smart, A., *Hidden order emerges in stream networks* 2013, Physics Today.

Chu, J., *A new 'branch' of math* 2012, MIT news.

Bosak, T and Petroff, A., *Photosynthesis on the early Earth* 2010, Science for the Public: Public Lecture Series.

Althausm J., *From Local to Global to Mars?!* 2010, The Nature Conservancy Florida Chapter News.

Bettex M., *Bacterial growths may offer clues about Earths distant past* 2010, MIT News Office. Published in: Astrobiology, Science Daily, Space Daily, Terra Daily, Red Orbit.

Unearthing the Flow 2009, Nature Geoscience.

Howard, A., *Forming Valleys From Below* 2009, Nature Geoscience.