Scott D. Pauls

Curriculum Vitae

Department of Mathematics
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EDUCATION

Ph.D., Mathematics, University of Pennsylvania, May 1998
B.A., Mathematics, Columbia University, May 1992

EMPLOYMENT

2016 to present, Chair, Department of Mathematics, Dartmouth College
2014 to present, Professor of Mathematics, Dartmouth College
2007 to present, Faculty, Quantitative Social Science, Dartmouth College
2007-2016, Vice Chair, Department of Mathematics, Dartmouth College
2007-2014, Associate Professor of Mathematics, Dartmouth College
2001-2007, Assistant Professor of Mathematics, Dartmouth College
1998-2001, G.C. Evans Instructor, Rice University

RESEARCH AREAS

Applied Mathematics: complex systems, network theory, applications to neuroscience and the social sciences.

Pure Mathematics: Carnot-Carathéodory (sub-Riemannian) geometry, optimization problems in the sub-Riemannian setting, including minimal and isoperimetric surface questions.

Thesis Advisor: Christopher B. Croke, University of Pennsylvania
Thesis Title: *On Quasi-isometric Invariants: Rigidity and Related Phenomena*

PUBLICATIONS

Articles

As I publish in different fields with different author order conventions, I have highlighted my name in bold when author order is not merely alphabetical.

1. Pauls, S. D., The large-scale geometry of nilpotent Lie groups, *Comm. Anal. Geom.*, **9** (2001), no. 5, 951-982.
2. Pauls, S. D., A notion of rectifiability modeled on Carnot groups, *Indiana Univ. Math. J.* **53** (2004), 49-82.

3. Pauls, S. D., Minimal surfaces in the Heisenberg group, *Geom. Ded.* 104 (2004), 201-231.
4. Cole, D. and Pauls, S. D., C^1 hypersurfaces of the Heisenberg group are N-rectifiable, *Houston J. Math.* 32:6 (2006), 713-724.
5. Pauls, S. D., H-minimal graphs of low regularity in H, *Comm. Math. Helv.* 81 (2006), 337-384.
6. Hladky, R. and Pauls, S. D., Constant mean curvature surfaces in sub-Riemannian geometry, *J. Diff. Geom.* 79:1 (2008), 111-139.
7. Leibon, G., Pauls, S. D., Rockmore, D., and Savell, R., Topological Structures in the Equities Market Network, *PNAS*, 105:52 (2008), 20589-20594. (doi: 10.1073/pnas.0802806106) ✲
8. Danielli, D., Garofalo, N., Nhieu, D. M., and Pauls, S. D., Instability of graphical strips and a positive answer to the Bernstein problem in the Heisenberg group, *J. Diff. Geom.*, 81:2 (2009), 251-296.
9. Pauls, S. D., Cortical Feature maps via Geometric models, *J. Physiology (Paris),* 103 (2009), 46-51.
10. Hladky, R. and Pauls, S. D., Minimal surfaces in the Roto-translation group with applications to a neuro-biological image completion model, *J. Math. Imaging and Vision.* 36:1 (2010), 1-34.
11. Capogna, L., Pauls, S. D., Tyson, J., Convexity in Carnot groups and the horizontal second fundamental form, *Trans. Amer. Math. Soc.* **362** (2010), 4045-4062.
12. Danielli, D., Garofalo, N., Nhieu, D. M., and Pauls, S. D., The Bernstein Problem for Embedded Surfaces in the Heisenberg Group H^1, *Indiana University Journal of Mathematics,* **59** (2010), 563-594.
13. Braun, R., Leibon, G., **Pauls, S. D.**, and Rockmore, D., Partition Decoupling for Multi-gene Analysis of Gene Expression Profiling Data, *BMC Bioinformatics.* **12**:497 (2011). (doi:10.1186/1471-2105-12-497)
14. Remondini, D. and Pauls, S. D., A notion of centrality based on the spectrum of the Laplacian, *Phys. Rev. E.,* **85:**066127 (2012). (http://link.aps.org/doi/10.1103/PhysRevE.85.066127) ✲
15. Hladky, R. and Pauls, S. D., Area Variations in sub-Riemannian geometry, *Int. Elec. J. Geom.* 6:1 (2013), 8-40. (http://www.iejgeo.com/matder/dosyalar/makale-121/2013-v6-n1-2.pdf).
16. Foti, N., Pauls, S. D., and Rockmore, D., Stability of the world trade network over time: an extinction analysis, *J. Economic Dynamics and Control,* 37:9 (2013), 1889-1910. (http://dx.doi.org/10.1016/j.jedc.2013.04.009)
17. **Pauls, S. D.,** Foley, N., LaSautier, J., Hastings, M., Maywood, E., and Silver, R., Differential contributions of intra- and inter-cellular mechanisms to spatial and temporal architecture of the suprachiasmatic nucleus circadian circuitry in wild-type, CRY- and VPAC2 –null mutant mice, *Eur. J. Neuroscience.* 40:3 (2014), 2528-2540. (http://onlinelibrary.wiley.com/doi/10.1111/ejn.12631/full)

    Featured article: Piggins, H. D. "Identifying spatial and temporal organization in the circadian clock (Commentary on Pauls et al.)", EJN, 40:3 (2014) 2527. (http://onlinelibrary.wiley.com/doi/10.1111/ejn.12670/full).

18. Davis, M., Anthony, D., and **Pauls, S. D.**, Seeking and receiving social support on Facebook for surgery, *Social Science & Medicine,* 131 (2015) 40-47. *(*doi:10.1016/j.socscimed.2015.02.038)
19. **Pauls, S. D.**, Leibon, G., and Rockmore, D., The Social Identity Voting model: ideology from community structures, *Research and Politics,* April-June 2015, 1-11. (doi: 10.1177/2053168015570415)

    Pauls, S. D., 2015, Replication Data for: The Social Identity Voting model: ideology and community structures, http://dx.doi.org/10.7910/DVN/IMLVVG, Harvard Dataverse.
20. Brocklebank, S., **Pauls, S. D**., Rockmore, D., and Bates, T. C., A Spectral Clustering Approach to the Structure of Personality: Contrasting the FFM and HEXACO Models," *Journal of Research in Personality*, 57 (2015), 100-109. (doi:10.1016/j.jrp.2015.05.003)
21. **Pauls, S. D.**, Honma, K-I., Honma, S., Silver, R., Deconstructing circadian rhythmicity with models and manipulations, *Trends in Neuroscience,* 49:6 (2016). 405-419. (http://dx.doi.org/10.1016/j.tins.2016.03.006).
22. Khoo, T., Fu, F., **Pauls, S. D.**, Coevolution of Cooperation and Partner Rewiring Range in Spatial Social Networks, *Nature Communications,* 6 (2016), 36293. (http://www.nature.com/articles/srep36293)
23. **Pauls, S. D.** and Cranmer, S., Affinity Communities in United Nations Voting: Implications for Conflict, Cooperation, and Democracy, *Physica A*, 484 (2017), 428-439. (https://doi.org/10.1016/j.physa.2017.04.177)
24. DeFord, D. R. and Pauls, S. D., A new framework for dynamics on multiplex networks, *J. Complex Networks.* (https://doi.org/10.1093/comnet/cnx041)
25. Myung, J. and **Pauls, S. D.,** Encoding seasonal information in a two-oscillator model of the multi-oscillator circadian clock, *Eur. J. Neuroscience.* (2017) (doi: 10.1111/ejn.13697)
26. Cogswell, C., **Pauls, S. D**., Gauthier, A., DeSilva, E., Schroer, K., Agile and Active: Sustaining Pedagogical Change in a Large-Enrollment Calculus Course, accepted paper for the 2017 ASHE Conference.
27. Leib-Lappan, R., Kumar, D., Obbard, R., and Pauls, S. D. A network model for characterizing brine channels in sea ice, *The Cryosphere.*

Under review:

28. DeFord, D. R. and Pauls, S. D., Spectral clustering methods for multiplex networks.
29. Khoo, T., Fu, F., **Pauls, S. D.**, Double-edged effect of spillover on cooperation in multiplex games.

In preparation:

30. DeFord D. R. and Pauls, S. D., Choices of structural models for modularity maximization in multiplex networks.
31. Malik, N. and **Pauls, S. D.**, Structural analysis of investment networks.

Books and Monographs

1. Capogna, L., Danielli, D., Pauls, S. D., and Tyson, J., An Introduction to the Heisenberg group and the sub-Riemannian isoperimetric problem, Progress in Mathematics, volume 259. Birkhauser, 2007.

GRANTS AND FELLOWSHIPS

NSF, ARC-1304134, $534,884 (PI: R. Obbard, Co-PI: Scott Pauls) "Characterization of brine network microstructure in first year arctic sea ice," September 1, 2013 – February 28, 2018.

McLane Family Fellowship, 2014-2015.

AFOSR, $752,687 (PI: D. Rockmore, Co-PI: Scott Pauls), "Dynamic Information Networks: Geometry, Topology, and Statistical Learning for the Articulation of Structure," July 1, 2011 – June 30, 2015.

Gridley Faculty Fellowship, 2011.

Gordon Russell 1955 Fellowship, 2007-2008.

NSF, DMS-0548644 $27,000, (PI: J. Tyson, Co-PIs: L. Capogna and Scott Pauls), "Conference on geometric analysis and applications", July 12-15, 2006, University of Illinois at Urbana-Champaign

NSF, DMS-0503695, $20,000, (PI: Scott Pauls, Co-PIs: L. Capogna and J. Tyson), "Workshop on minimal surfaces, subelliptic PDEs and geometric analysis", March 8-13, 2005, Dartmouth College.

NSF, DMS-0306752, $449,566, (PI: Carolyn Gordon, Co-PIs: Peter Doyle, Scott Pauls and David Webb) July 1, 2003 – June 30, 2007.

NSF, DMS-9971563, $53,459 (Post-doctoral addition to Michael Wolf's grant) July 1, 2000 - June 30, 2003.

Graduate Research Fellowships at the University of Pennsylvania, Fall 1992, 1995, 1997, Spring 1993

RECENT PROFESSIONAL EXPERIENCE

- Agile and Active: Sustaining Pedagogical Change in a Large-Enrollment Calculus Course, accepted paper for the 2017 ASHE Conference, November 2017
- Accepted Talk, *Spectral Clustering Methods for Multiplex Networks,* SIAM Workshop on Network Science, Pittsburgh, PA, June 2017.
- Invited workshop, *Community Detection,* Political Networks, June 2017.
- Invited workshop, *Community Detection,* Political Networks, June 2015.

- Accepted Poster, *Affinity communities among state actors in the United Nations,* Political Networks, May 28-31, 2014.
- Invited Speaker, AMS Special Session, Albuquerque, NM, April 2014.
- Colloquium, *Systemic Risk: Robustness and Fragility in Trade Networks*, Worchester Polytechnic Institute, December 2013.
- Invited Speaker, *Geometric Models in Vision,* Institute Henri Poincaré, October 2013 (declined).
- Invited Speaker, Theodology Seminar, *Robustness and stability in trade networks,* Department of Sociology, Princeton University, March, 2013.
- Invited Speaker, *Dynamic Information Networks,* Complex Networks 2012, Washington D.C, AFSOR, December 20, 2012.
- Invited Speaker, *Partition Decoupling for Roll Call data,* Computational Social Science Series, UMass, Amherst, December 7, 2012.
- Invited Speaker, *Robustness in the WTW*, Conference on Emergent Risk, Princeton University, September 27-29, 2012.
- Accepted Paper, *Partition Decoupling in Roll Call Data,* Political Networks, June13-16, 2012.

HONORS AND AWARDS

McLane Family Fellowship, 2014-2015
Senior Faculty Fellowship, Spring 2014
Gridley Faculty Fellow, 2011-2012
Gordon Russell 1955 Fellowship, 2007-2008
School of Arts and Sciences 1997 Dean's Award for Distinguished Teaching
Moez Alimohamed Graduate Student Teaching Award, 1995
Departmental Teaching Award, Fall 1993, 1994, 1996, Spring 1995, 1996

MEMBERSHIPS

American Mathematical Society (AMS)
American Association for the Advancement of Science (AAAS)
Society for Industrial and Applied Mathematicians (SIAM)

STUDENTS AND MENTORING

Post-doctoral mentoring:

1. Robert Hladky, Dartmouth College, Mathematics, 2004-2006
2. Nishant Malik, Dartmouth College, Mathematics, 2015-2018

Graduate Students:

1. Danielle Cole, Dartmouth College, Mathematics, 2005
   Thesis title: *On minimal surfaces in Martinet-type spaces.*
2. Greg Petrics, Dartmouth College, Mathematics, 2011
   Thesis title: *Roto-translation space and the visual cortex.*
3. Katherine Kinnaird, Dartmouth College, Mathematics, 2014
   Thesis title: *Aligned Hierarchies for Sequential Data*

4. Ross Leib-Lappon, Dartmouth College, Engineering, 2016 (co-adviser)
   Thesis Title: *How sea ice microstructure influences the polar transport of salts from the ocean to the atmosphere.*
5. Tommy Khoo, Dartmouth College, Mathematics, 2018 (co-adviser)
6. Daryl DeFord, Dartmouth College, Mathematics, 2018 (co-adviser)
7. Elizabeth Tripp, Dartmouth College, Mathematics, 2020

Undergraduate Mentoring:

1. Alyssa Anderson, 2007 (thesis)
2. Patrick Karas, 2008 (research project, 2006-2008)
3. Katherine Roddy, 2011 (Presidential Scholar 2009-10)
4. Melissa Bearden, 2012 (research project, 2011-2012)
5. Valentina Semenova, 2013 (thesis)
6. Madeline Kreher, 2013 (thesis)
7. Mahnum Shahzad, 2015 (research project, Winter 2015)
8. Sarah McGowan, 2016 (Presidential Scholar 2014-15)
9. Matthew Jin, 2017 (Sophomore Science Scholar 2014-15)
10. Deip Kumar, 2018 (research project, 2016-2017)
11. Lefteris Nakos, 2018 (research project, Spring 2016)
12. Katherine Royce, 2019 (Presidential Scholar 2017-18)
13. Brian Schoenfeld, 2019 (Presidential Scholar 2017-18)

SERVICE

Chair, Department of Mathematics, 2016-present
Steering Committee for the Quantitative Social Science Program, 2009-present
Committee on Priorities (CPr), 2012-15, chair 2014-15, 2016-2019
King Scholar Steering Committee, 2013-present
FYSEP Steering Committee, 2011-present
FYSEP Faculty Participant, 2010-present
Presidential Task Force on Enrollment Scale, 2017-2018
Department of Physics External Review Committee, Winter 2018
External Member, Earth Sciences Recruiting Committee, 2017-2018
Advisor to First Year students for Mathematics, 2002-2017
Vice-chair, Department of Mathematics, 2007-2016
Faculty Coordinating Committee, 2007-10, 2014-15
Steering Committee for the Institute for Writing and Rhetoric, 2013-15
Classroom Committee, 2011-2016
Committee on Organization and Policy (COP), 2011-12
Undergraduate Program Committee, 2001-2, 2003-5, 2006-7 (chair), 2015-2016
Mathematics Recruiting Committee (chair 2013-14), 2011-2016
Graduate Program Committee, 2005-6, 2007-9 (chair), 2010-11 (chair), 2011-12
Strategic Planning Committee, Graduate Education for the Future, 2011-12
Committee on Instruction (COI), 2006-10, chair 2007-10
Search Committee, Writing Program Director, 2008
Graduate Admissions Committee, 2001-3