Scott D. Pauls

Curriculum Vitae

Department of Mathematics
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Lebanon, NH 03766

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EDUCATION

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

EMPLOYMENT

2014 to present, Professor of Mathematics, Dartmouth College
2007 to 2014, Associate Professor of Mathematics, Dartmouth College
2007 to present, Vice Chair, Department 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

Journal Articles

Appeared:

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)

Under review:

21. Pauls, S.D. and Cranmer, S., Affinity Communities in United Nations Voting: Implications for Conflict, Cooperation, and Democracy, submitted to *PNAS*.
22. Deford, D. and Pauls, S. D., Network models that reflect multiplex dynamics, submitted to *Phys. Rev. E.*

In preparation:

23. Deford, D. and Pauls, S. D., Multiplex spectral clustering, in preparation.
24. Deford, D. and Pauls, S. D., Dynamically motivated centralities for multiplex networks in preparation.
25. Lazarou, N-J., Dette, T., Pauls, S. D., and Rockmore, D., Robustness and Contagion in the International Financial Network, under revision.
26. Pauls, S. D. and Foley, D. Statistical graph-theoretic methods for analyzing neuroscience data, in preparation.

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.
2. Leibon, G., Pauls, S. D., and Rockmore, D., Statistical Learning for Complex Systems, under contract with Princeton University Press.

GRANTS AND FELLOWSHIPS

McLane Family Fellowship, 2014-2015.

NSF Grant, 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 – August 31, 2016.

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

NSF Grant, DMS-9971563, $53,459 (PI: Michael Wolf, supported as a post-doc) July 1, 2000 - June 30, 2003.

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

RECENT PROFESSIONAL EXPERIENCE

- 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.
- Accepted paper, *Spectral Centralities,* Eighth International Conference on Complex Systems, New England Complex Systems Institute, June, 2011.
- Invited Speaker, AMS Special Session, Worcester, MA, April 6-8,2011.

- Invited Speaker, AMS Special Session, Lexington, KY, March 26-28, 2010.

<u>HONORS AND AWARDS</u>

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

<u>STUDENTS AND MENTORING</u>

Post-doctoral mentoring:

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

Graduate Students:

Primary advisor:

1. Daniel 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. Tommy Khoo, Dartmouth College, Mathematics, 2018 (expected)

Committee member:

5. Ross Leib-Lappon, Dartmouth College, Engineering, 2019 (expected)

Undergraduate Mentoring:

1. Alyssa Anderson, 2007 (thesis)
2. Patrick Karas, 2008 (research project)
3. Katherine Roddy, 2011 (Presidential Scholar 2009-10)
4. Melissa Bearden, 2012 (research project)
5. Valentina Semenova, 2013 (thesis)
6. Madeline Kreher, 2013 (thesis)
7. Mahnum Shahzad, 2015 (research project)
8. Sarah McGowan, 2016 (Presidential Scholar 2014-15)
9. Matthew Jin, 2017 (Sophomore Science Scholar 2014-15)

King Scholar Steering Committee, 2013-present
FYSEP Steering Committee, 2011-present
FYSEP Faculty Participant, 2010-present
Vice-chair, Department of Mathematics, 2007-present
Steering Committee for the Quantitative Social Science Program, 2009-present
Affiliated Faculty, Quantitative Social Science Program, 2007-present.
Advisor to First Year students for Mathematics, 2002- present
Committee on Priorities (CPr), 2012-15, chair 2014-15
Faculty Coordinating Committee, 2007-10, 2014-15
Steering Committee for the Institute for Writing and Rhetoric, 2013-15
Classroom Committee, 2011-2014
Committee on Organization and Policy (COP), 2011-12
Mathematics Recruiting Committee (chair), 2011-12
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
Undergraduate Program Committee, 2001-2, 2003-5, 2006-7 (chair)
Graduate Admissions Committee, 2001-3