



## PETER J. MUCHA

### DEPARTMENT OF MATHEMATICS

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### EDUCATION

- Ph. D. Applied and Computational Mathematics, **Princeton University**, Princeton, NJ, 1998.
- M. A. Applied and Computational Mathematics, **Princeton University**, Princeton, NJ, 1996.
- M. Phil. Physics, **University of Cambridge**, Cambridge, UK, 1995.
- B. S. Engineering Physics, **Cornell University**, Ithaca, NY, 1993.

### EMPLOYMENT

- 2005– **University of North Carolina**, Chapel Hill, NC  
Department of Mathematics  
Department of Applied Physical Sciences (previously the Institute for Advanced Materials)  
Assistant Professor (2005–7), Associate Professor (2007–10), Professor (since 2011),  
Bowman and Gordon Gray Distinguished Term Professor (2012–2017).
- 2001–2005 **Georgia Institute of Technology**, Atlanta, GA  
School of Mathematics, Assistant Professor.
- 1998–2001 **Massachusetts Institute of Technology**, Cambridge, MA  
Department of Mathematics, Applied Mathematics Instructor.

### ADMINISTRATIVE & VISITING APPOINTMENTS

- 2017– Director, Chairs Leadership Program, Institute for the Arts and Humanities, UNC.
- 2016–2017 Visiting Professor, Department of Mathematics, Duke University.
- 10–11/2015 Chair of the Faculty (Acting), Office of Faculty Governance, UNC.
- 1/2015–6/2016 Natural Sciences Faculty Advisor, Office of Research Development, UNC.
- 1/2013–12/2014 Chair (Founding), Department of Applied Physical Sciences, UNC.
- 7/2010–12/2012 Chair, Department of Mathematics, UNC.

### HONORS AND AWARDS

- 2016 Inaugural Outstanding Postdoc Mentor Award, UNC Office of Postdoctoral Affairs (only awardee in cohort outside the School of Medicine).
- 2014 Inductee, Order of the Golden Fleece, UNC's oldest and highest honorary society, for significant, lasting contributions to the University.
- 2012 Bowman and Gordon Gray Distinguished Term Professorship (UNC College of Arts and Sciences, for excellence in undergraduate teaching).
- 2007 National Science Foundation Faculty Early Career Development Award (CAREER).
- 2004 Professor of the Month (February), Georgia Tech chapter of Lambda Sigma (sophomore-year leadership, scholarship & service society).
- 2003 Department of Energy Early Career Principal Investigator in Applied Mathematics.
- 1999 National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship.
- 1993 National Science Foundation Graduate Fellowship.
- 1993 Winston Churchill Foundation Scholarship.

## AWARDS RELATED TO PUBLICATIONS

- 2017 SIGEST selection, SIAM Review (refereed pubs. #47 & #70).
- 2016 SIAM Student Paper Prize to Natalie Stanley (refereed pub. #65).
- 2016 Political Ties Award, American Political Science Association (refereed pub. #61).
- 2015 *Chaos* collection “25 Articles for 25 Years” (refereed pub. #39, representing 2013).
- 2011 Winning entry, APS Gallery of Nonlinear Images (expository pub. #11).
- 2010 Winning entry, APS Gallery of Nonlinear Images (expository pub. #10).
- 2009 Winning entry, APS Gallery of Nonlinear Images (expository pub. #9).
- 2006 Winning entry, APS Gallery of Nonlinear Images (expository pub. #6).
- 2005 Best Paper Award, Symposium on Computer Animation (refereed pub. #12).

## REFEREED RESEARCH PUBLICATIONS

Google Scholar h-index: 37 (<http://goo.gl/05pLpX>)

- 77. “Epidemic spreading in localized environments with recurrent mobility patterns,” C. Granell & —, *Physical Review E* **97**, 052302 (2018).
- 76. “Care coordination and multispecialty teams in the care of colorectal cancer patients,” J. G. Trogdon, Y. Chang, S. Shai, —, T.-M. Kuo, A. M. Meyer & K. B. Stitzenberg, *Medical Care* **56**, 430–435 (2018).
- 75. “Network-ensemble comparisons with stochastic rewiring and von Neumann entropy,” Z. Li<sup>†</sup>, — & D. Taylor, *SIAM Journal of Applied Mathematics* **78**, 897–920 (2018).
- 74. “Evolutionary prisoner’s dilemma games coevolving on adaptive networks,” H.-W. Lee\*, N. Malik & —, *Journal of Complex Networks* **6**, 1–23 (2018).
- 73. “The scaling structure of the global road network,” E. Strano, A. Giometto, S. Shai, E. Bertuzzo, — & A. Rinaldo, *Royal Society Open Science* **4**, 170590 (2017).
- 72. “Super-resolution community detection for layer-aggregated multilayer networks,” D. Taylor, R. S. Caceres & —, *Physical Review X* **7**, 031056 (2017).
- 71. “Post-processing partitions to identify domains of modularity optimization,” W. H. Weir\*, S. Emmons<sup>†</sup>, R. Gibson<sup>†</sup>, D. Taylor & —, *Algorithms* **10**, 93 (2017).
- 70. “Core-periphery structure in networks (revisited),” M. P. Rombach, M. A. Porter, J. H. Fowler & —, *SIAM Review* **59**, 619–646 (2017).
- 69. “A local perspective on community structure in multilayer networks,” L. G. S. Jeub\*, M. W. Mahoney, — & M. A. Porter, *Network Science* **5**, 144–163 (2017).
- 68. “Eigenvector-based centrality measures for temporal networks,” D. Taylor, S. A. Myers<sup>†</sup>, A. Clauset, M. A. Porter & —, *Multiscale Modeling and Simulation* **15**, 537–574 (2017).
- 67. “Transitivity reinforcement in the coevolving voter model,” N. Malik, F. Shi, H.-W. Lee\* & —, *Chaos* **26**, 123112 (2016).
- 66. “Enhanced detectability of community structure in multilayer networks through layer aggregation,” D. Taylor, S. Shai, N. Stanley\* & —, *Physical Review Letters* **116**, 228301 (2016).
- 65. “Clustering network layers with the strata multilayer stochastic block model,” N. Stanley\*, S. Shai, D. Taylor & —, *IEEE Trans. Network Science and Engineering* **3**, 95–105 (2016).
- 64. “Climate shocks and migration: An agent-based modeling approach,” B. Entwisle, N. E. Williams, A. M. Verdery\*, R. R. Rindfuss, S. J. Walsh, G. P. Malanson, —, B. G. Frizzelle, P. M. McDaniel, X. Yao, B. W. Heumann\*, P. Prasartkul, Y. Sawangdee & A. Jampaklay, *Population and Environment* **38**, 47–71 (2016).
- 63. “Spatiotemporal patterns and trends of Indian monsoonal rainfall extremes,” N. Malik, B. Bookhagan & —, *Geophysical Research Letters* **43**, 1710–1717 (2016).
- 62. “Network structure and biased variance estimation in respondent driven sampling,” A. M. Verdery\*, T. Mouw, S. Bauldry & —, *PLOS ONE* **10**, e0145296 (2015).

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\*: graduate students, †: undergraduate students

REFEREED RESEARCH PUBLICATIONS (continued)

61. “Kantian fractionalization predicts the conflict propensity of the international system,” S. J. Cranmer, E. J. Menninga\* & —, *Proc. National Academy of Sciences* **112**, 11812–11816 (2015).
60. “Network analysis reveals sex- and antibiotic resistance-associated antivirulence targets in clinical uropathogens,” K. S. Parker, J. D. Wilson\*, J. Marschall, — & J. P. Henderson, *ACS Infectious Diseases* **1**, 523–532 (2015).
59. “Topological data analysis of contagion maps for examining spreading processes on networks,” D. Taylor, F. Klimm\*, H. A. Harrington, M. Kramár, K. Mischaikow, M. A. Porter & —, *Nature Communications* **6**, 7723 (2015).
58. “Modeling of virion collisions in cervicovaginal mucus reveals limits on agglutination as the protective mechanism of secretory immunoglobulin A,” A. Chen, S. A. McKinley, F. Shi, S. Wang\*, —, D. Harit, M. G. Forest, S. K. Lai, *PLOS ONE* **10**, e0131351 (2015).
57. “Think locally, act locally: Detection of small, medium-sized, and large communities in large networks,” L. G. S. Jeub\*, P. Balachandran, M. A. Porter, — & M. W. Mahoney, *Physical Review E* **91**, 012821 (2015).
56. “A testing based extraction algorithm for identifying significant communities in networks,” J. D. Wilson\*, S. Wang\*, —, S. Bhamidi & A. B. Nobel, *Annals of Applied Statistics* **8**, 1853–1891 (2014).
55. “Nonaxisymmetric high-aspect-ratio ellipsoids under shear: Lowest-order correction for finite aspect ratios,” F. Shi\* & —, *Physical Review E* **90**, 013005 (2014).
54. “Modeling neutralization kinetics of HIV by broadly neutralizing monoclonal antibodies in genital secretions coating the cervicovaginal mucosa,” S. A. McKinley, A. Chen, F. Shi\*, S. Wang\*, —, M. G. Forest & S. K. Lai, *PLOS ONE* **9**, e100598 (2014).
53. “Fluctuation of similarity (FLUS) to detect transitions between distinct dynamical regimes in short time series,” N. Malik, N. Marwan, Y. Zou, — & J. Kurths, *Physical Review E* **89**, 062908 (2014).
52. “A narrow-band gradient-augmented level set method for multiphase incompressible flow,” C. Lee\*, J. Dolbow & —, *Journal of Computational Physics* **273**, 12–37 (2014).
51. “Transient antibody-mucin interactions produce a dynamic molecular shield against viral invasion,” A. Chen, S. A. McKinley, S. Wang\*, F. Shi\*, —, M. G. Forest & S. K. Lai, *Biophysical Journal* **106**, 2028–2036 (2014).
50. “Dynamics on modular networks with heterogeneous correlations,” S. Melnik, M. A. Porter, — & J. P. Gleeson, *Chaos* **24**, 023106 (2014).
49. “Resolving structural variability in network models and the brain,” F. Klimm<sup>†</sup>, D. S. Bassett, J. M. Carlson & —, *PLOS Computational Biology* **10**, e1003491 (2014).
48. “Network-based assessments of percolation-induced current distributions in sheared rod macromolecular dispersions,” F. Shi\*, S. Wang\*, M. G. Forest, — & R. Zhou, *Multiscale Modeling and Simulation* **12**, 249–264 (2014).
47. “Core-periphery structure in networks,” M. P. Rombach\*, M. A. Porter, J. H. Fowler & —, *SIAM Journal of Applied Mathematics* **74**, 167–190 (2014).
46. “Cross-linked structure of network evolution,” D. S. Bassett, N. F. Wymbs\*, M. A. Porter, — & S. T. Grafton, *Chaos* **24**, 013112 (2014).
45. “Multiopinion coevolving voter model with infinitely many phase transitions,” F. Shi\*, — & R. Durrett, *Physical Review E* **88**, 062818 (2013).
44. “Percolation-induced exponential scaling in the large current tails of random resistor networks,” F. Shi\*, S. Wang\*, M. G. Forest & —, *Multiscale Modeling and Simulation* **11**, 1298–1310 (2013).
43. “Role of social environment and social clustering in spread of opinions in coevolving networks,” N. Malik & —, *Chaos* **23**, 043123 (2013).

\*: graduate students, †: undergraduate students

REFEREED RESEARCH PUBLICATIONS (continued)

42. “Task-based core-periphery organization of human brain dynamics,”  
D. S. Bassett, N. F. Wymbs\*, M. P. Rombach\*, M. A. Porter, — & S. T. Grafton,  
*PLOS Computational Biology* **9**, e1003171 (2013).
41. “Dynamic network centrality summarizes learning in the human brain,”  
A. V. Mantzaris, D. S. Bassett, N. F. Wymbs\*, E. Estrada, M. A. Porter, —, S. T. Grafton &  
D. J. Higham, *Journal of Complex Networks* **1**, 83–92 (2013).
40. “Portrait of political party polarization,” J. Moody & —, *Network Science* **1**, 119–121 (2013).
39. “Robust detection of dynamic community structure in networks,” D. S. Bassett, M. A. Porter,  
N. F. Wymbs\*, S. T. Grafton, J. M. Carlson & —, *Chaos* **23**, 013142 (2013).
38. “Design of an agent-based model to examine population-environment interactions in Nang Rong District,  
Thailand,” S. J. Walsh, G. P. Malanson, B. Entwisle, R. R. Rindfuss, —, B. W. Heumann\*,  
P. M. McDaniel, B. G. Frizzelle, A. Verdery\*, N. Williams, Y. Xiaozheng & D. Ding,  
*Applied Geography* **39**, 183–198 (2013).
37. “Taxonomies of networks from community structure,” J.-P. Onnela, D. J. Fenn\*, S. Reid†,  
M. A. Porter, —, M. D. Fricker & N. S. Jones, *Physical Review E* **86**, 036104 (2012).
36. “Dynamical clustering of exchange rates,” D. J. Fenn\*, M. A. Porter, —, M. McDonald, S. Williams,  
N. F. Johnson & N. S. Jones, *Quantitative Finance* **12**, 1493–1520 (2012).
35. “Differential recruitment of the sensorimotor putamen and frontoparietal cortex during motor chunking  
in humans,” N. F. Wymbs\*, D. S. Bassett, —, M. A. Porter & S. T. Grafton, *Neuron* **74**, 936–946 (2012).
34. “Social structure of Facebook networks,”  
A. L. Traud\*, — & M. A. Porter, *Physica A* **391**, 4165–4180 (2012).
33. “Graph fission in an evolving voter model,” R. Durrett, J. P. Gleeson, A. L. Lloyd, —, F. Shi\*, D. Sivakoff,  
J. E. S. Socolar & C. Varghese\*, *Proc. National Academy of Sciences* **109**, 3682–3687 (2012).
32. “Accuracy of mean-field theory for dynamics on real-world networks,”  
J. P. Gleeson, S. Melnik, J. A. Ward, M. A. Porter & —, *Physical Review E* **85**, 026106 (2012).
31. “Community structure in the United Nations General Assembly,”  
K. T. Macon†, — & M. A. Porter, *Physica A* **391**, 343–361 (2012).
30. “A new method for simulating rigid body motion in incompressible two-phase flow,”  
J. Sanders\*, J. E. Dolbow, — & T. A. Laursen, *Int. J. Numerical Methods in Fluids* **67**, 713–732 (2011).
29. “Comparing community structure to characteristics in online collegiate social networks,”  
A. L. Traud†, E. D. Kelsic†, — & M. A. Porter, *SIAM Review* **53**, 526–543 (2011).
28. “Dynamic reconfiguration of human brain networks during learning,”  
D. S. Bassett, N. F. Wymbs\*, M. A. Porter, —, J. M. Carlson & S. T. Grafton,  
*Proc. National Academy of Sciences* **108**, 7641–7646 (2011).
27. “The unreasonable effectiveness of tree-based theory for networks with clustering,”  
S. Melnik, A. Hackett\*, M. A. Porter, — & J. P. Gleeson, *Physical Review E* **83**, 036112 (2011).
26. “Community structure in time-dependent, multiscale, and multiplex networks,”  
—, T. Richardson†, K. Macon†, M. A. Porter & J.-P. Onnela, *Science* **328**, 876–878 (2010).
25. “Mutually-antagonistic interactions in baseball networks,”  
S. Saavedra, S. Powers†, T. McCotter†, M. A. Porter & —, *Physica A* **389**, 1131–1141 (2010).
24. “Fluid simulation with articulated bodies,” N. Kwatra\*, C. Wojtan\*, M. Carlson, I. Essa, — & G. Turk,  
*IEEE Transactions on Visualization and Computer Graphics* **16**, 70–80 (2010).
23. “Virtual rheoscopic fluids,” F. Hecht\*, — & G. Turk,  
*IEEE Transactions on Visualization and Computer Graphics* **16**, 147–160 (2010).

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\*: graduate students, †: undergraduate students

REFEREED RESEARCH PUBLICATIONS (continued)

22. “Spectral tripartitioning of networks,”  
T. Richardson<sup>†</sup>, — & M. A. Porter, *Physical Review E* **80**, 036111 (2009).
21. “Velocity fluctuations in a low-Reynolds-number fluidized bed,”  
S.-Y. Tee, —, M. P. Brenner & D. A. Weitz, *Journal of Fluid Mechanics* **596**, 467–475 (2008).
20. “Community structure in Congressional cosponsorship networks,” Y. Zhang<sup>†</sup>, A. J. Friend<sup>†</sup>,  
A. L. Traud<sup>†</sup>, M. A. Porter, J. H. Fowler & —, *Physica A* **387**, 1705–1712 (2008).
19. “Velocity fluctuations of initially stratified sedimenting spheres,”  
S.-Y. Tee, —, M. P. Brenner & D. A. Weitz, *Physics of Fluids* **19**, 113304 (2007).
18. “Random walker ranking for NCAA Division I-A football,”  
T. Callaghan<sup>†</sup>, — & M. A. Porter, *American Mathematical Monthly* **114**, 761–777 (2007).
17. “Statistical reconstruction of velocity profiles for nanoparticle image velocimetry,”  
C. Hohenegger\* & —, *SIAM Journal of Applied Mathematics* **68**, 239–252 (2007).
16. “Animating corrosion and erosion,” C. Wojtan\*, M. Carlson, — & G. Turk,  
*Eurographics Workshop on Natural Phenomena*, 15–22 (2007).
15. “Community structure in the United States House of Representatives,”  
M. A. Porter, —, M. E. J. Newman & A. J. Friend<sup>†</sup>, *Physica A* **386**, 414–438 (2007).
14. “Diffusion-induced bias in near-wall velocimetry,” R. Sadr, C. Hohenegger\*, H. Li\*, — & M. Yoda,  
*Journal of Fluid Mechanics* **577**, 443–456 (2007).
13. “Keyframe control of complex particle systems using the adjoint method,” C. Wojtan\*, — & G. Turk,  
*ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, 15–23 (2006).
12. “Particle-based simulation of granular materials,” W. N. Bell<sup>†</sup>, Y. Yu & —,  
*ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, 77–86 (2005).
11. “Water drops on surfaces,” H. Wang\*, — & G. Turk,  
*ACM Transactions on Graphics (SIGGRAPH)* **24**, 921–929 (2005).
10. “A network analysis of committees in the U.S. House of Representatives,” M. A. Porter, —,  
M. E. J. Newman & C. M. Warmbrand<sup>†</sup>, *Proc. National Academy of Sciences* **102**, 7057–7062 (2005).
9. “Rigid Fluid: Animating the interplay between rigid bodies and fluid,”  
M. Carlson\*, — & G. Turk, *ACM Transactions on Graphics (SIGGRAPH)* **23**, 377–384 (2004).
8. “A model for velocity fluctuations in sedimentation,” —, S.-Y. Tee\*, D. A. Weitz, B. I. Shraiman  
& M. P. Brenner, *Journal of Fluid Mechanics* **501**, 71–104 (2004).
7. “A Stokes flow boundary integral measurement of tubular structure cross sections in two dimensions,”  
M. Niethammer\*, E. Pichon, A. Tannenbaum & —, *IEEE Intl. Conf. Image Processing*, 825–828 (2003).
6. “Diffusivities and front propagation in sedimentation,”  
— & M. P. Brenner, *Physics of Fluids* **15**, 1305–1313 (2003).
5. “Nonuniversal velocity fluctuations of sedimenting particles,” S.-Y. Tee\*, —, L. Cipelletti, S. Manley\*,  
M. P. Brenner, P. N. Segrè & D. A. Weitz, *Physical Review Letters* **89**, 054501 (2002).
4. “Melting and flowing,” M. Carlson\*, —, B. Van Horn\* & G. Turk,  
*ACM SIGGRAPH/Eurographics Symposium on Computer Animation*, 167–174 (2002).
3. “Fast fluid analysis for multibody micromachined devices,” X. Wang\*, — & J. White,  
*Tech. Proc. of the Fourth Intl. Conference on Modeling and Simulation of Microsystems*, 19–22 (2001).
2. “Partial screening in dense lattice-configuration suspensions,”  
—, I. Goldhirsch, S. A. Orszag & M. Vergassola, *Physical Review Letters* **83**, 3414–3417 (1999).
1. “Spectroscopic study of electrons emitted in Ar<sup>q+</sup> ( $8 \leq q \leq 16$ ) on Ar at 2.3q keV collision energy,”  
J. Vancura, — & V. O. Kostroun, *Physical Review A* **53**, 2379–2390 (1996).

\*: graduate students, †: undergraduate students

## EXPOSITORY & NON-REFEREED PUBLICATIONS

14. “Case studies in network community detection,” S. Shai, N. Stanley, C. Granell, D. Taylor & —, to appear in *The Oxford Handbook of Social Networks* [arXiv:1705.02305].
13. “What can Political Science learn from Mathematics? An interview with Peter Mucha”, —, in *The Oxford Handbook of Political Networks*, 921–924 (2017).
12. “Scientific training in the era of big data: A new pedagogy for graduate education,” J. Aikat, T. M. Carsey, K. Fecho, K. Jeffay, A. Krishnamurthy, —, A. Rajasekar & S. C. Ahalt, *Big Data* **5**, 12–18 (2017).
11. “Mathematical genealogy and department prestige,” S. A. Myers<sup>†</sup>, — & M. A. Porter, *Chaos* **21**, 041104 (2011).
10. “Communities in multislice voting networks,” — & M. A. Porter, *Chaos* **20**, 041108 (2010).
9. “Visualization of communities in networks,” A. L. Traud\*, C. Frost<sup>†</sup>, — & M. A. Porter, *Chaos* **19**, 041104 (2009).
8. “Communities in networks,” M. A. Porter, J.-P. Onnela & —, *Notices of the American Mathematical Society* **56**, 1082–1097 & 1164–1166 (2009).
7. “Party polarization in Congress: A network science approach,” A. S. Waugh\*, L. Pei<sup>†</sup>, J. H. Fowler, — & M. A. Porter, arXiv:0907.3509.
6. “Community structure in the U.S. House of Representatives,” M. A. Porter, A. J. Friend<sup>†</sup>, — & M. E. J. Newman, *Chaos* **16**, 041106 (2006).
5. “Modeling of debris deposition in an extrusion filter medium,” C. L. Cox, E. W. Jenkins & —, *Proc. of 21st Annual Meeting of the Polymer Processing Society* (2005).
4. “The Bowl Championship Series: A mathematical review,” T. Callaghan<sup>†</sup>, — & M. A. Porter, *Notices of the American Mathematical Society* **51**, 887–893 (2004).
3. “That sinking feeling,” M. P. Brenner & —, *Nature* **409**, 568–570 News & Views (2001).
2. “On zero Reynolds number microhydrodynamics of particulate suspensions,” Ph. D. Thesis, Princeton University, 1998 (Advisors: S. A. Orszag & I. Goldhirsch).
1. “Finite deformation of an elastic membrane: A model for epiretinal membrane separation,” M. Phil. Thesis, University of Cambridge, 1994 (Advisor: M. Warner).

## SELECTED SUBMITTED PUBLICATIONS

- “Testing alignment of node attributes with network structure through label propagation,” N. Stanley\*, M. Niethammer & —, arXiv:1805.07375.
- “Stochastic block models with multiple continuous attributes,” N. Stanley\*, T. Bonacci, R. Kwitt, M. Niethammer & —, arXiv:1803.02726.
- “Rigid graph compression: Motif-based rigidity analysis for disordered fiber networks,” S. Heroy\*, D. Taylor, F. Shi, M. G. Forest & —, arXiv:1711.05790.
- “Social clustering in epidemic spread on coevolving networks,” H.-W. Lee\*, N. Malik, F. Shi & —, arXiv:1707.04933.
- “Compressing networks with super nodes,” N. Stanley\*, R. Kwitt, M. Niethammer & —, arXiv:1706.04110.
- “Feature-based classification of networks,” I. Barnett, N. Malik, M. L. Kuijjer, — & J.-P. Onnela, arXiv:1610.05868.

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\*: graduate students, †: undergraduate students

# PETER J. MUCHA

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## SOFTWARE PACKAGES

2. “CHAMP package: Convex Hull of Admissible Modularity Partitions in Python and MATLAB,” William H. Weir\*, Ryan Gibson† & —, <http://github.com/wweir827/CHAMP> (2017).
1. “A generalized Louvain method for community detection implemented in MATLAB,” Lucas G. S. Jeub\*, Marya Bazzi\*, Inderjit S. Jutla† & —, <http://netwiki.amath.unc.edu/GenLouvain> (2011–2016).

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\*: graduate students, †: undergraduate students

## TEACHING EXPERIENCE

### University of North Carolina

- Math 89 *Networks: The Science of the Connected World*, Fall 2013, First Year Seminar, 21 students.
- Math 231 *BioCalculus I*, Fall 2005–2008, for biology and health science majors, 13–33 students each semester (information available at <http://biocalculus.amath.unc.edu>).
- Math 232 *BioCalculus II*, Spring 2006, for biology and health science majors, 20 students.
- Math 233 *Multivariable Calculus*, Fall 2009, Fall 2011 & Spring 2018, 39–131 students.
- Math 528 *Mathematical Methods for the Physical Sciences I*, Fall 2007, for science undergraduates, 34 students.
- Math 529 *Mathematical Methods for the Physical Sciences II*, Spring 2008 & 2010, for science undergraduates, 30–35 students.

### Duke University (visiting faculty)

- Math 790 *Analysis of Network Data*, Fall 2016, one-credit graduate module, 22 students.

### Georgia Institute of Technology

- Math 2403 *Differential Equations*, 5 times in 2002–2005, following Edwards & Penney, 38–165 students each semester.
- Math 6514 *Industrial Mathematics*, Fall 2003, 2004, for mathematics and engineering graduate students, including asymptotics, modeling and computation, 10–32 students each semester.
- Math 6640 *Introduction to Numerical Methods for Partial Differential Equations*, Fall 2001, 2002, for mathematics and engineering graduate students, 20–25 students each year.
- Math 6646 *Numerical Methods for Ordinary Differential Equations*, Spring 2002, 2004, for mathematics and engineering graduate students, 21–33 students each year.

### Massachusetts Institute of Technology

- 18.022 *Multivariable Calculus* Sections, Fall 1998, 1999, following Rogers, ~55 students each year.
- 18.086 *Mathematical Methods for Engineers II*, Spring 1999, for engineering graduate students, focusing on differential equations and introductory numerical methods, 60 students.
- 18.336 *Numerical Methods of Applied Mathematics II*, Fall 2000, for mathematics and engineering graduate students, with emphasis on partial differential equations, 12 students.

### The College of New Jersey (adjunct faculty)

- Math 229 *Multivariable Calculus*, Fall 1997, 24 students.

## TEACHING AND TRAINING GRANTS

- 8/2010–7/2017 “EMSW21-RTG: Laboratory and Mathematical Fluid Dynamics: Experiments, Computation and Modeling,” NSF DMS-0943851, \$1,199,980 [Co-PI, PI: Richard McLaughlin].
- 9/2005–8/2009 “UBM: Quantitative Systems Biology,” NSF DMS-0531908, \$300,000 [Co-PI, PI: Mark Borodovsky].
- 9/2003–5/2004 “Mobile Wireless Computing Laboratory,” Georgia Tech Technology Fee award, \$110,083 [Co-PI, PI: Lew Lefton].

# PETER J. MUCHA

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## RESEARCH COLLABORATIONS WITH TRAINEES

*Other students indicated in publications were student collaborators officially supervised elsewhere.*

### Ph.D. Student Supervisions (9)

- 2018– Andrew Hinton,<sup>a</sup> Curriculum in Bioinformatics & Computational Biology, UNC.  
2016– William Weir,<sup>b</sup> Curriculum in Bioinformatics & Computational Biology, UNC (MD/PhD).  
2014–2018 Sam Heroy,<sup>c</sup> Department of Mathematics, UNC (postdoc at Oxford).  
2014–2018 Natalie Stanley, Curriculum in Bioinformatics & Computational Biology, UNC (postdoc at Stanford).  
2013–2016 Hsuan-Wei “Wayne” Lee, Department of Mathematics, UNC (postdoc at University of Nebraska–Lincoln).  
2010–2014 Simi Wang,<sup>c</sup> Department of Mathematics, UNC (data analyst, Amazon).  
2008–2013 Feng “Bill” Shi,<sup>c</sup> Department of Mathematics, UNC. (data scientist, Odum Institute, UNC; previously postdoc at University of Chicago).  
2003–2006 Christel Hohenegger, School of Mathematics, GT (faculty at University of Utah; previously postdoc at Courant Institute, NYU).  
2001–2004 Mark Carlson,<sup>d</sup> College of Computing, GT (Research and Games DevTech at NVIDIA; previously at Dreamworks Animation, Walt Disney Animation Studios, DNA Productions).

### M.S. Student Supervisions (7)

- 2014–2015 Alexis Sparko, Department of Mathematics, UNC.  
2013–2014 Joan Pharr, Department of Mathematics, UNC.  
2008–2010 Amanda “Mandi” Traud, Department of Mathematics, UNC.  
2008–2009 Benjamin Perryman, Department of Mathematics, UNC.  
2005–2006 Swathi Guda, Department of Mathematics, UNC.  
2004–2005 Svetlana Bukharina, School of Mathematics, GT.  
2004–2005 Radleigh Santos, School of Mathematics, GT.

### Undergraduate Research Supervisions Leading to Publications and Packages (16)

- Scott Emmons (2016–), Ryan Gibson (2016–), Zichao Li (2015–16), Florian Klimm (Humboldt University of Berlin, Summer 2012), Inderjit Jutla (Berkeley, Summer 2011), Sean Myers (2009–13), Kevin Macon (2008–10), Christi Frost (St. Scholastica, Summer 2008), Scott Powers (2007–9), Trent McCotter (2007–8), Thomas Richardson (2006–8), Amanda “Mandi” Traud (2006–8), A. J. Friend (Spr–Sum 2005),<sup>e</sup> Thomas Callaghan (2003–5),<sup>e</sup> Casey Warmbrand (Sum–Fall 2003),<sup>e</sup> W. Nathan Bell (2002–3).  
*Other undergraduate research experience supervisions: 36.*

### Mentoring collaborations with Postdoctoral Scholars (8)

- 2018– Eun Lee.  
2016–2018 Peter Diao, SAMSI Postdoctoral Fellow.  
2016–2017 Clara Granell, JSMF Postdoctoral Fellow (Postdoc, Universitat de Barcelona).  
2014–2017 Saray Shai (Faculty, Wesleyan University).  
2013–2017 Dane Taylor, SAMSI Postdoctoral Fellow (Faculty, University at Buffalo).  
2011–2015 Nishant Malik (Faculty at RIT; previously Instructor at Dartmouth).  
2009–2011 Bruce Rogers, SAMSI Postdoctoral Fellow (consulting; previously at Augustana College).  
2003–2005 Mason Porter, VIGRE Visiting Assistant Professor, School of Mathematics, GT [one of three co-mentors] (Faculty, UCLA; previously at Oxford and postdoc at Caltech).

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*a:* co-advised with Wesley Burks, *b:* co-advised with William Kim, *c:* co-advised with Greg Forest, *d:* co-advised with Greg Turk, *e:* co-advised with Mason Porter.



# PETER J. MUCHA

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## ACTIVE RESEARCH GRANTS

- 12/2017–11/2021 “Metabolomic Mechanisms of Nutritional Immunity in the Urinary Tract,” NIDDK R01-DK111930, \$1,371,873 [Co-PI with Jeff Henderson (WashU-StL)].
- 9/2016–8/2019 “Dynamic Network Analysis: Analyzing the Chronnectome,” NSF ECCS-1610762, \$356,420 [Co-PI with Marc Niethammer].
- 6/2016–5/2018 “A Network-Science-Integrated Feedback Loop for Design of Multifunctional Polymeric Rod-Like Nanocomposites,” ARO W911NF-16-1-0356, \$550,974 [Co-PI with Greg Forest, Theo Dingemans & Daphne Klotsa].
- 9/2013–12/2018 “Models and Tools for Dynamic Health-Relevant Diffusion over Complex Networks,” NICHD R01-HD075712, \$1,740,568 [Co-PI with James Moody (Duke), UNC: \$869,469].
- 1/2013–12/2020 “Community Detection in Networks Across Time,” James S. McDonnell Foundation Scholar Award in Complex Systems, \$450,000 [Sole PI].

## PREVIOUS RESEARCH GRANTS

- 9/2016–9/2017 “Intestinal Metabolomic Factors Affecting *C. difficile* Colonization and Infection,” CDC, \$498,427 [under award 200-2016-91965 with Jeff Henderson (WashU-StL), UNC: \$79,224].
- 9/2016–8/2017 “Metabolomic Mechanisms of Nutritional Immunity in the Urinary Tract,” NIDDK R56-DK111930, \$125,160 [Co-PI with Jeff Henderson (WashU-StL), UNC: \$26,635].
- 1/2015–12/2016 “Multi-layer Networks in Cancer Care,” UNC UCRF Innovation Award, \$362,064 [Co-PI with Justin Trogdon, Anne Marie Meyer & Karyn Stitzenberg].
- 5/2012–4/2016 “Multiscale Mathematics of Nano-Particle-Endowed Active Membranes & Films,” AFOSR subcontract from U.S.C, \$399,375 [PI: Qi Wang, UNC PI: Greg Forest].
- 10/2012–10/2015 “Statistical Multiscale Property Metrics for Nanorod and Nanoplatelet Composite Membranes and Films,” ARO W911NF-13-1-0013, \$300,000 [Co-PI with Greg Forest].
- 8/2011–7/2014 “Identifying Essential Network Properties for Disease Spread,” NIGMS R21-GM099493, \$364,568 [Sole PI].
- 7/2007–6/2013 “CAREER: Model Fluid-Solid Interactions, Networks REUs, and BioCalculus,” NSF DMS-0645369, \$417,500 [Sole PI].
- 7/2011–6/2012 “An Interdisciplinary Approach to Computational Politics and Policy,” UNC Interdisciplinary Initiative Seed Grant, \$10,000 [w/S. Bhamidi, J. Gross, J. C. Scott].
- 9/2007–6/2012 “Dynamically Integrating Macro and Micro Processes,” NIEHS R21-ES016729, \$1,149,885 [PI: Barbara Entwisle].
- 9/2007–2/2012 “DHB: Marginality in a Marginal Environment: An Agent-Based Approach to Population-Environment Relationships,” NSF BCS-0728822, \$699,960 [PI: Barbara Entwisle].
- 7/2009–6/2010 “Dyadic Dependence and Modularity in International Conflict,” UNC Odum Institute Seed Award, \$8,400 [Co-PI with S. Cranmer].
- 7/2009–6/2010 “Network-Aware Modeling of HIV,” Pilot Award in Racial/Ethnic Health Disparities, UNC ECHO, \$14,909 [Sole PI].
- 9/2006–8/2010 “MSPA-MCS: Simulation and Visualization of Flow at Interfaces,” NSF CCF-0625190, \$84,729 [as co-PI to Greg Turk (Georgia Tech) on NSF CCF-0625264, \$383,204].
- 9/2003–8/2007 “Model Interacting Particle Systems for Simulation and Macroscopic Description of Particulate Suspensions,” DOE ASCR, DE-FG-02-03ER25567, \$299,591 [Sole PI].
- 6/2002–5/2005 “Simulations and Models for Sedimentation at Small Reynolds Numbers,” NSF DMS-0204309, \$118,429 [Sole PI].
- 7/1999–6/2002 Mathematical Sciences Postdoctoral Research Fellowship, NSF DMS-9902363, \$90,000. [Sole PI].

# PETER J. MUCHA

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## SELECTED INVITED PRESENTATIONS

- Dec 12, 2017 *Network Frontier Workshop*, Evanston, IL (virtual workshop).  
Oct 18, 2017 *Graduate Group in Applied Mathematics (GGAM) Annual Meeting*, UC Davis.  
Oct 17, 2017 *Data Institute SF Annual Conference*, San Francisco, CA.  
June 20, 2017 *ISODS III (NetSci 2017 Satellite)*, Indianapolis, IN.  
March 23, 2017 *Mathematics Colloquium*, University of Utah.  
March 2, 2017 *Algorithms Seminar*, Duke University.  
March 21, 2016 *Generalized Network Structures and Dynamics*, Mathematical Biosciences Institute.  
Oct 24, 2015 Plenary Speaker, *Triangle Area Graduate Math Conference*, Raleigh, NC.  
Sept 22, 2015 *Widely Applied Mathematics Seminar*, Harvard University.  
July 17, 2015 *Graph Exploitation Symposium*, MIT Lincoln Laboratory.  
April 17, 2015 *Complex Systems Seminar*, University of Pennsylvania.  
Jan 16, 2015 *Political Science Seminar*, Ohio State University.  
Jan 11, 2015 *AMS Special Session on Network Science*, Joint Mathematics Meetings, San Antonio, TX.  
Nov 24, 2014 *PACM Colloquium*, Princeton University.  
March 7, 2014 *Wireless Intelligent Sensor Networks Seminar*, Duke University.  
Feb 7, 2014 *Institute for Quantitative Theory and Methods*, Emory University.  
Jan 4, 2014 *Dynamics Days US*, Atlanta, GA.  
Dec 5, 2013 *Network Frontier Workshop*, Evanston, IL.  
July 9, 2013 *Workshop on Time-Dependent and Multiplex Networks*, University of Oxford.  
Sept 6, 2012 *Computer Science and Mathematics Division Seminar*, Oak Ridge National Laboratory.  
July 19, 2012 Plenary Speaker, *Society for Political Methodology, PolMeth XXIX*, Chapel Hill, NC.  
June 19, 2012 *Networks: the Science of Science & Innovation (NetSci 2012 Satellite)*, Evanston, IL.  
April 23, 2012 *Computational & Applied Mathematics Colloquium*, Rice University.  
Nov 4, 2011 *Computational Social Science Seminar*, University of Massachusetts.  
Oct 11, 2011 *Mathematics Colloquium*, Rensselaer Polytechnic Institute.  
March 30, 2011 *KITP Colloquium*, University of California, Santa Barbara.  
July 19, 2010 *Analytical Solutions and Applications*, SAS, Cary, NC.  
Feb 3, 2010 *Mathematics Colloquium*, University of Notre Dame.  
Nov 10, 2009 *Seminar*, Santa Fe Institute.  
Feb 24, 2009 *Applied Mathematics Seminar*, University of Delaware.  
Oct 29, 2008 *Differential Equations Seminar*, North Carolina State University.  
April 30, 2008 *Applied and Computational Math Seminar*, University of North Carolina, Charlotte.  
Jan 30, 2007 *Center for Nonlinear and Complex Systems Seminar*, Duke University.  
Oct 16, 2006 *Applied Mathematics and Analysis Seminar*, Duke University.  
Sept 12, 2006 *SAMSI Program on Computer Models Opening Workshop*, RTP, NC.  
Sept 24, 2005 Southeastern Atlantic Mathematical Sciences Workshop, Chapel Hill, NC.  
April 21, 2005 *Center for Nonlinear Science Seminar*, Georgia Institute of Technology.  
Jan 26, 2005 *Theoretical & Applied Mechanics Seminar*, Cornell University.  
Sept 8, 2004 *Computations in Science Seminar*, University of Chicago.  
June 30, 2004 *Gordon Research Conference on Granular and Granular-Fluid Flow*, Waterville, ME.  
June 2, 2004 *Interdisciplinary Fluid Physics Seminar*, University of California, Santa Barbara.  
April 28, 2004 *Analysis & Computational Math Seminar*, Clemson University.  
April 5, 2004 *Chemical Engineering Seminar*, University of Florida.  
May 6, 2003 *Applied Mathematics Seminar*, University of Delaware.  
Feb 26, 2003 *Applied Math – PDE Seminar*, University of Wisconsin.  
Feb 3, 2003 *Applied Mathematics Seminar*, University of Illinois.  
Nov 5, 2002 *Applied Mathematics Colloquium*, University of Washington.  
May 10, 2002 *Dynamical Systems and Nonlinear Science Seminar*, Princeton University.  
Feb 6, 2001 *Microfluid Dynamics Seminar*, Massachusetts Institute of Technology.  
Jan 16, 2001 *Mathematics Colloquium*, University of Michigan.

Other invited presentations include Duke, Georgia Tech, Harvard, MIT, NYU, Princeton, RPI, Stanford, UCSB, UMass, UNM, Utah, Yale and 3M.

# PETER J. MUCHA

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## SELECTED SERVICE AND LEADERSHIP ACTIVITIES

### Public Outreach & Educational Presentations

- May 16, 2018 *Social Networks and Health Scholars Training Program*, Duke Network Analysis Center  
(also in previous years: May 23, 2017 and May 18, 2016).
- June 20, 2017 Invited Speaker, “One Great Idea” Session, *Symposium for the Society of Young Network Scientists (NetSci 2017 Satellite)*, Indianapolis, IN.
- May 15, 2017 Plenary Speaker, *SAMSI Interdisciplinary Workshop for Undergraduates*, RTP, NC.
- May 19, 2014 *SAMSI Undergraduate Modeling Workshop*, RTP, NC.
- May 29–31, 2013 *Summer School in Network Science*, University of South Carolina.
- April 14, 2012 “Ask a Scientist” Booth, UNC Science Expo.
- Sept 25, 2010 Public Speaker, UNC Science Expo, “Network Analysis: Connections & Communities” and “Ask a Scientist” Booth.
- Dec 4, 2008 Public Speaker, Morehead Planetarium and Science Center Current Science Forum, “The Tangled Webs We Weave: An Inside Look at Network Science.”
- May 8, 2004 *CNN* quiz segment in celebration of annual MATHCOUNTS competition.
- Dec 30, 2003 *CNN Headline News* segment on college football rankings (with Thomas Callaghan).

### Campus Committees

- 2017– Faculty Committee on University Government.
- 2016–2017 Advisor, Data Science Initiative Committee.
- Summer 2016 Search Committee for Director of Ethics Education and Policy Management.
- Spring 2016 Chair, Administrative Review Committee for Renaissance Computing Institute (RENCI).
- Spring 2016 Data Science Professional Science Master’s Curriculum Committee.
- 2014–2016 Administrative Board, School of Information and Library Science.
- 2014–2016 Quality Enhancement Plan Steering Committee.
- 2013–2016 Chancellor’s Advisory Committee (Chair, 2014–15 & 2015–16).
- 2013–2014 Bowman and Gordon Gray Distinguished Term Professor Selection Committee.
- Fall 2013 Internal member, Bioinformatics and Computational Biology Program Review.
- 2013 Search Committee for Associate Vice Chancellor for Research.
- 2012–2013 Board of Trustees’ Visions Committee on Models of Undergraduate Education.
- 2012–2013 College Task Force for Transforming Instruction in Large Lecture Classes.
- 2012– Co-Director, Social Network Analysis at Carolina interdisciplinary initiative
- 2010– Advisory Board, Duke Network Analysis Center.
- 2005– UNC-CH Churchill Scholarship Nominating Committee (Chair, 2007–2010).

### Editorial, Conference & Society Service

- May 2019 Co-organizer, SIAM Workshop on Network Science (NS19).
- 2017–2018 Faculty Fellow, SAMSI Program on Precision Medicine.
- 2018– SIAM Committee on Science Policy.
- Oct 2017 Network Analysis Track Leader, Data Institute SF Annual Conference.
- July 2017 Program Committee, SIAM Workshop on Network Science (NS17).
- 2017– Associate Editor, *SIAM Journal on Applied Mathematics*.
- Sept 2016 Breakout Session Leader, Future Directions in Network Science Workshop, Arlington, VA.
- Jan 2016 Program Committee, Dynamics Days.
- July 2015 Mentor, NSF-NIH Innovations Lab on Interdisciplinary Biomedical Data Science.
- 2013– Editorial Board, *Frontiers in Applied Dynamical Systems: Reviews and Tutorials*.
- 2010–2011 Co-organizer and Faculty Fellow, SAMSI Program Year on Complex Networks.
- May 20, 2010 Invited “Ask the Experts” Plenary Panel, Political Networks Conference, Durham, NC.

### Leadership Development

- July 2014 Leading Strategically Program, Center for Creative Leadership, Colorado Springs, CO.
- 2013–2014 Faculty Learning Community on Strategy and Leadership, Center for Faculty Excellence, UNC.
- Spring 2012 Academic Leadership Program Fellow, Institute for the Arts and Humanities, UNC.
- May 2011 Leadership Development Program, Center for Creative Leadership, Greensboro, NC.
- May 2011 Chancellor’s Faculty Entrepreneurship Boot Camp, UNC.
- 2010–2011 Chairs Leadership Program, Institute for the Arts and Humanities, UNC.