Zachary P. Kilpatrick http://www.colorado.edu/amath/zpkilpat
University of Colorado Boulder, Assistant Professor, Applied Mathematics (zpkilpat@colorado.edu)

Education

2007 – 2010 **University of Utah**, PhD in Mathematics
2005 – 2007 **University of Utah**, M.S. in Mathematics
2001 – 2005 **Rice University**, B.A. in Computational and Applied Mathematics

Academic Appointments

2016 – **University of Colorado Boulder**, Assistant Professor, Applied Mathematics
2016 – **University of Colorado School of Medicine**, Affiliate Faculty, Physiology & Biophysics
2016 – 2018 **University of Houston**, Research Assistant Professor, Mathematics
2012 – 2016 **University of Houston**, Assistant Professor, Mathematics
2010 – 2012 **University of Pittsburgh**, NSF Mathematical Sciences Postdoctoral Research Fellow

Grants

amount to Kilpatrick home department in **bold**

2017 – NIH – National Institute of Mental Health (co-PI with J. Gold & K. Josić: **$282,078**)
CRCNS: Decision making in changing environments

2016 – NSF DMS – Mathematical Biology (PI: **$234,000**)
Robust spatiotemporal dynamics in multi-layer neuronal networks

2016 – 2017 NSF DMS – Conference Proposal (PI with J. Gjorgjieva & R. Rosenbaum: **$20,000**)
2016 – 2017 Burroughs Wellcome Fund – Conference Award (co-PI with J. Gjorgjieva: **$5,000**)
2016 – 2017 SIAM – Conference Award (co-PI with J. Gjorgjieva & R. Rosenbaum: **$5,000**)
International Conference on Mathematical Neuroscience

2015 – NSF DMS – Mathematical Biology (co-PI with K. Josić: **$329,445**)
The ever-changing network: How changes in architecture shape neural computations

2013 – 2017 NSF DMS – Mathematical Biology (sole PI: **$184,937**)
Architecture for robust spatiotemporal dynamics in neuronal networks

2013 – 2014 University of Houston, GEAR (co-PI with K. Josić: **$30,000**)
Forecasting in biological networks: How organisms see the future

2013 University of Houston, New Faculty Research Grant (sole PI: **$6,000**)
Robust neural field models for decision making with multiple alternatives

2010 – 2012 NSF DMS Postdoctoral Research Fellowship (sole PI: **$135,000**)

Refereed Journal Articles

undergrads*; grad students‡; postdocs†; equal contribution

1. G. Faye & Z.P. Kilpatrick, *Threshold of front propagation in neural fields: An interface dynamics approach*, **SIAM J Appl. Math.** submitted. **arXiv:** https://arxiv.org/abs/1801.05878
2. N. Krishnan*, D.B. Poll‡, & Z.P. Kilpatrick, *Interacting bumps model of item limitations in working memory*, **J. Comput. Neurosci.** submitted. **arXiv:** https://arxiv.org/abs/1710.11612
3. Z.P. Kilpatrick, *Synaptic mechanisms of interference in working memory*, **Sci. Rep.** submitted. **bioRxiv:** https://doi.org/10.1101/149435
4. Z.P. Kilpatrick & D.B. Poll‡, *Neural field model of memory-guided search*, **Phys. Rev. E** 96 (2017) 062411.
5. D.B. Poll‡ & Z.P. Kilpatrick, *Velocity integration in a multilayer neural field model of spatial working memory*, **SIAM J Appl. Dyn. Syst.** 16 (2017) pp. 1197-1234.

6. A.E. Radillo, A. Veliz-Cuba, K. Josić, & Z.P. Kilpatrick, *Evidence accumulation and change rate inference in dynamic environments*, **Neural Comput.** 29, (2017) pp. 1561-1610.
7. A. Jacot-Guillarmod, Y. Wang, C. Pedroza, H. Öğmen, Z.P. Kilpatrick, & K. Josić, *Extending Levelt's Propositions to perceptual multistability involving interocular grouping*, **Vision Res.** 133, (2017) pp. 37-46.
8. Z.P. Kilpatrick, *Ghosts of bump attractors in stochastic neural fields: Bottlenecks and extinction*, **Discrete Contin. Dynam. Syst. Ser. B** 21 (2016) pp. 2211-2231.
9. Z.T. McCleney* & Z.P. Kilpatrick, *Entrainment in up and down states of neural populations: non-smooth and stochastic models*, **J. Math. Biol.** 73 (2016) pp. 1131-1160..
10. D.B. Poll‡ & Z.P. Kilpatrick, *Persistent search in confined domains: a velocity-jump process model*, **J. Stat. Mech.** (2016) 053201.
11. D.B. Poll‡, K. Nguyen*, & Z.P. Kilpatrick, *Sensory feedback in a bump attractor model of path integration*, **J. Comput. Neurosci.** 40 (2016) pp. 137-155.
12. A. Veliz-Cuba†, Z.P. Kilpatrick, & K. Josić, *Stochastic models of evidence accumulation in changing environments*, **SIAM Rev.** 58 (2016) pp. 264-289.
13. A. Veliz-Cuba†, H.Z. Shouval, K. Josić, & Z.P. Kilpatrick, *Networks that learn the precise timing of event sequences*, **J Comput. Neurosci.** 39 (2015) pp. 235-254.
14. D.B. Poll‡ & Z.P. Kilpatrick, *Stochastic motion of bumps in planar neural fields*, **SIAM J Appl. Math.** 75 (2015) pp. 1553-1577.
15. Z.P. Kilpatrick, *Stochastic synchronization of neural activity waves*, **Phys. Rev. E** 91 (2015) 040701(R).
16. P.C. Bressloff & Z.P. Kilpatrick, *Nonlinear Langevin equations for wandering patterns in stochastic neural fields*, **SIAM J Appl. Dyn. Syst.** 14 (2015) pp. 305-334.
17. Z.P. Kilpatrick, *Delay stabilizes stochastic motion of bumps in layered neural fields*, **Physica D** 295 (2015) pp. 30-45.
18. Z.P. Kilpatrick & G. Faye, *Pulse bifurcations in stochastic neural fields*, **SIAM J Appl. Dyn. Syst.** 13 (2014) pp. 830-860.
19. J.K. Kim†, Z.P. Kilpatrick, M.R. Bennett, & K. Josić, *Molecular mechanisms that regulate the coupled period of the mammalian circadian clock*, **Biophys. J** 106 (2014) pp. 2071-2081.
20. Z.P. Kilpatrick, *Coupling layers regularizes wave propagation in stochastic neural fields*, **Phys. Rev. E** 89 (2014) 022706.
21. S. Carroll*, K. Josić, & Z.P. Kilpatrick, *Encoding certainty in bump attractors*, **J Comput. Neurosci.** 37 (2014) pp. 29-48.
22. Z.P. Kilpatrick, B. Ermentrout, & B. Doiron, *Optimizing working memory with heterogeneity of recurrent cortical excitation*, **J Neurosci.** 33 (2013) pp. 18999-19011.
23. Z.P. Kilpatrick, *Interareal coupling reduces encoding variability in multi-area models of spatial working memory*, **Front. Comput. Neurosci.** 7 (2013) 82.
24. Z.P. Kilpatrick & B. Ermentrout, *Wandering bumps in stochastic neural fields*, **SIAM J Appl. Dyn. Syst.** 12 (2013) pp. 61-94.
25. Z.P. Kilpatrick, *Short term synaptic depression improves information transfer in perceptual multistability*, **Front. Comput. Neurosci.** 7 (2013) 85.
26. S.M. Jayasuriya* & Z.P. Kilpatrick, *Effects of time-dependent stimuli on a competitive neural network model of perceptual rivalry*, **Bull. Math. Biol.** 6 (2012) pp. 1396-1426.

27. Z.P. Kilpatrick & B. Ermentrout, *Response of traveling waves to transient inputs in neural fields*, **Phys. Rev. E** 85 (2012) 021910.
28. Z.P. Kilpatrick & G.B. Ermentrout, *Hallucinogen persisting perception disorder in neuronal networks with adaptation*, **J Comput. Neurosci.** 32 (2012) pp. 25-53.
29. Z.P. Kilpatrick & G.B. Ermentrout, *Sparse gamma rhythms arising through clustering in adapting neuronal networks*, **PLoS Comput. Biol.** 7 (2011), e1002281.
30. P.C. Bressloff & Z.P. Kilpatrick, *Two–dimensional bumps in piecewise smooth neural fields with synaptic depression*, **SIAM J Appl. Math.** 71 (2011) pp. 379-408.
31. Z.P. Kilpatrick & P.C. Bressloff, *Binocular rivalry in a competitive neural network model with synaptic depression*, **SIAM J Appl. Dyn. Syst.** 9 (2010) pp. 1303-1347.
32. Z.P. Kilpatrick & P.C. Bressloff, *Stability of bumps in piecewise smooth neural networks with nonlinear adaptation*, **Physica D** 239 (2010) pp. 1048-1060.
33. Z.P. Kilpatrick & P.C. Bressloff, *Spatially structured oscillations in a two-dimensional excitatory neuronal network with synaptic depression*, **J Comput. Neurosci.** 28 (2010) pp. 193-209.
34. Z.P. Kilpatrick & P.C. Bressloff, *Effects of synaptic depression and adaptation on spatiotemporal dynamics of an excitatory neuronal network*, **Physica D** 239 (2010) pp. 547-560.
35. P.C. Bressloff & Z.P. Kilpatrick, *Nonlocal Ginzburg-Landau equation for cortical pattern formation*, **Phys. Rev. E** 78 (2008) 041916.
36. Z.P. Kilpatrick, S.E. Folias, & P.C. Bressloff, *Traveling pulses and wave propagation failure in inhomogeneous neural media*, **SIAM J Appl. Dyn. Syst.** 7 (2008), pp. 161-185.

Book Chapters and Book Reviews

B1. Z.P. Kilpatrick, *Book Review: Methods and Models in Mathematical Biology (Johannes Muller and Christina Kuttler)*, **SIAM Rev.** 59 (2017) pp. 211-214.

B2. Z.P. Kilpatrick, *Wilson-Cowan model*, **Encyclopedia of Computational Neuroscience** (2014), Ed. D. Jaeger and R. Jung, Springer Verlag.

B3. G.B. Ermentrout, S.E. Folias, & Z.P. Kilpatrick, *Spatiotemporal pattern formation in neural fields with linear adaptation*, **Neural Field Theory** (2014), Ed. S. Coombes, P. beim Graben, R. Potthast and J.J. Wright, Springer Verlag.

Invited Talks

1. **AIMS Conference on Dynamical Systems**, Taipei TW, 7/2018
2. **Institut de Mathèmatiques de Toulouse**, Toulouse FR, 12/2017
3. **INRIA, NeuroMathComp Seminar**, Sophia Antipolis FR, 11/2017
4. **Mathematics of the Brain at Collège de France**, Paris FR, 11/2017
5. **Ecole Normale Supèrieure, Group for Neural Theory**, Paris FR, 11/2017
6. **University of Pennsylvania, Computational Neuroscience Seminar**, Philadelphia PA, 10/2017
7. **SIAM Central States Sectional Conference**, Fort Collins CO, 9/2017
8. **Colorado School of Mines, Applied Mathematics Colloquium**, Golden CO, 8/2017
9. **Mathematical Biosciences Institute–REU Capstone Conference**, Columbus OH, 8/2017
10. **SIAM Applications of Dynamical Systems**, Snowbird UT, 5/2017
11. **Pitt Workshop: Computing with Networks of Neurons**, Pittsburgh PA, 5/2017

12. **AMS Sectional Meeting**, Pullman WA, 4/2017
13. **BIRS Workshop: Brain Dynamics and Statistics**, Banff AB, 2/2017
14. **University of Colorado School of Medicine, Physiology Seminar**, Aurora CO, 11/2016
15. **Colorado State University, Applied Mathematics Seminar**, Fort Collins CO, 9/2016
16. **SIAM Life Sciences**, Boston MA, 7/2016
17. **Bernstein Sparks Workshop: Recurrent Network Theory**, Göttingen DE, 5/2016
18. **University of Arkansas, Physics Colloquium**, Fayetteville AR, 3/2016
19. **BIRS Workshop: Connecting Network Architecture and Computation**, Banff AB, 12/2015
20. **AMS Sectional Meeting**, New Brunswick NJ, 11/2015
21. **LSUHSC School of Medicine, Cell Biology and Anatomy Seminar**, New Orleans LA, 9/2015
22. **SIAM Applications of Dynamical Systems**, Snowbird UT, 5/2015
23. **University of Texas Conference on Learning and Memory**, Austin TX, 4/2015
24. **IMACS Nonlinear Waves**, Athens GA, 4/2015
25. **University of Colorado, Applied Mathematics Colloquium**, Boulder CO, 11/2014
26. **Houston Museum of Natural Science**, Sugar Land TX, 10/2014
27. **SIAM Life Sciences**, Charlotte NC, 8/2014
28. **AIMS Conference on Dynamical Systems**, Madrid ESP, 7/2014
29. **Nonlinear dynamics and stochastic methods**, Pittsburgh PA, 3/2014
30. **GCC Theoretical and Computational Neuroscience**, Houston TX, 1/2014
31. **University of Minnesota, Mathematical Biology Seminar**, Minneapolis MN, 11/2013
32. **Frontiers in Applied and Computational Mathematics**, Newark NJ, 6/2013
33. **IMA Workshop: Stochastic Modeling of Biological Processes**, Minneapolis MN, 5/2013
34. **IMACS Nonlinear Waves**, Athens GA, 3/2013
35. **SIAM Life Sciences**, San Diego CA, 8/2012
36. **Canadian Applied and Industrial Mathematical Society Meeting**, Toronto ON, 6/2012
37. **Progress in Neural Field Theory**, Reading UK, 4/2012
38. **University of Houston, Mathematics Colloquium**, Houston TX, 2/2012
39. **Hungarian Academy of Sciences, Neural Computing Seminar**, Budapest HU, 11/2011
40. **Spatio-temporal evolution equations and neural fields**, CIRM, Marseille FR, 10/2011
41. **Rice University, Computational and Applied Mathematics Colloquium**, Houston TX, 1/2011
42. **University of Nottingham, Mathematical Neuroscience Group**, Nottingham UK, 11/2009
43. **INRIA, NeuroMathComp Seminar**, Sophia Antipolis FR, 10/2009
44. **NIH-NIDDK, Laboratory of Biological Modeling Seminar**, Bethesda MD, 9/2009
45. **University of Pittsburgh, Mathematical Biology Seminar**, Pittsburgh, PA, 9/2009

Conference Organizing

- **International Conference on Mathematical Neuroscience**,
  Conference Chair, Boulder, CO, 6/2017
  Conference Co-Chair, Juan-les-Pins, FR, 6/2016

- **GCC Annual Conference on Theoretical and Computational Neuroscience**, (co-organizer) Rice University, Houston TX: 2014, 2015
- **Nonlinear and stochastic dynamics in large neuronal networks**, (with Jonathan Touboul) Minisymposium at SIAM Applications of Dynamical Systems, Snowbird UT, 5/2015
- **Neural mechanisms of working memory limits**, (with Albert Compte) Workshop at Annual Conference on Computational Neuroscience, Paris FR, 7/2013
- **Stochasticity in large networks of the brain**, (with Jonathan Touboul) Minisymposium at SIAM Applications of Dynamical Systems, Snowbird UT, 5/2013
- **Spatiotemporal dynamics in networks of the brain**, (with Stefanos Folias) Minisymposium at SIAM Life Sciences, San Diego CA, 8/2012
- **Criticality, threshold phenomena, and network dynamics**, (co-organizer) Conference at CBSG Theme Days, University of Pittsburgh, Pittsburgh PA, 5/2012
- **SIAM/MAA Mid-Atlantic Regional Applied Mathematics**, (co-organizer) Conference at Shippensburg University, Shippensburg PA, 4/2012
- **Sensorimotor processes reflected in spatiotemporal dynamics of neuronal activity**, (with Jian-Young Wu) Workshop at Computational Systems Neuroscience, Snowbird UT, 2/2012
- **The role of adaptation and depression in neuronal network dynamics** (with Rodica Curtu) Minisymposium at SIAM Life Sciences, Pittsburgh PA, 7/2010
- **Cortical network dynamics** (with Steve Coombes) Minisymposium at SIAM Life Sciences, Montreal QC, 8/2008
- **IGERT Annual Student Workshop** (co-organizer) Workshop at University of Utah, Salt Lake City UT, 5/2008

Teaching Experience

(# times taught in parentheses)

- **University of Colorado:** Boundary Value Problems/Fourier Series; Applied Probability; Mathematical Biology Seminar
- **University of Houston:** Mathematical Biology (4); Advanced Linear Algebra (2); Honors Engineering Mathematics (2)
- **University of Pittsburgh:** Calculus 1 & 2; **University of Utah:** Calculus for Biologists 1 & 2

Graduate Students Supervised

- Daniel Poll, **PhD** (UH), May 2017
  Dissertation: *Stochastic dynamics in bump attractor models of spatial working memory*;
  Postdoc: Northwestern University, Department of Engineering Sciences and Applied Mathematics

Postdoctoral Fellows Supervised

- Alan Veliz-Cuba (UH), 2013–2015; Three Refereed Publications
  Faculty Position: University of Dayton, Department of Mathematics

Other Trainees Supervised

- Kate Nguyeh, **graduate**, 2015–
  (co-advisor with Kresimir Josic, UH Math)
- Adrian Radillo, **graduate**, 2014–
  (co-advisor with Kresimir Josic, UH Math)

- Elliott Saslow, **undergraduate**, 2017– (with Zoe Donaldson, MCDB)
- Nikhil Krishnan, **undergrad**, 2017–
- Matthew Hansen, **undergrad**, 2016–2017
- Jacob Parelman, **postbac**, 2017 (with R. McKell Carter, Psychology)
- Courtney Van Den Elzen, **grad rotation** (IQ Bio Program), 2017
- Six undergrads at UH: two women; one Goldwater Scholar; and three publications.
- Two undergrads at U Pittburgh: one publication.

Dissertation Committees

- Callie Federer, Computational Biosciences (CU Denver), in progress
- Jay Stotsky, Applied Mathematics (CU Boulder), in progress
- John Nardini, Applied Mathematics (CU Boulder), in progress
- Adrian Radillo, Mathematics (UH), in progress
- Wei-Ting Li, Biology (UH), exp 2018
- Inomzhon Mirzaev, Applied Mathematics (CU Boulder), 2017
- Changan Liu, Mathematics (UH), 2017
- Jose Manuel Lopez, Mathematics (UH), 2014

Reviewing and Editing

- **Guest Editor:** Special Issue of the *Journal of Mathematical Neuroscience*
- **Grant Reviewer:** *Agence Nationale de la Recherche (France)*, *Wellcome Trust Fellowships (UK)*, and *NSF – MathBioSys*
- **Book Reviewer:** *SIAM* and *Taylor & Francis*
- **Conference Abstract Reviewer:** *Cosyne (2014, 2017, 2018)* and *International Conference on Mathematical Neuroscience (2016, 2017)*
- **Journal Referee** for *Biological Cybernetics*; *European Journal of Applied Mathematics*; *Frontiers in Computational Neuroscience*; *Frontiers in Systems Neuroscience*; *Journal of Computational Neuroscience*; *Journal of Mathematical Biology*; *Journal of Mathematical Neuroscience*; *Journal of Neurophysiology*; *Journal of Neuroscience*; *Neural Networks*; *Neurocomputing*; *Nonlinearity*; *Physica D*; *Physical Review E*; *Physical Review Letters*; *PLoS Computational Biology*; *PLoS One*; *Scientific Reports*; *SIAM Journal of Applied Dynamical Systems*; *SIAM Journal of Applied Mathematics*; and *SIAM Journal on Mathematical Analysis*

Memberships

- **Center for Neuroscience, University of Colorado Boulder**
- **Society for Industrial and Applied Mathematics**

Committees

- **Graduate Studies Committee**, CU Boulder, Department of Applied Mathematics, 2017–
- **College of Engineering/Applied Mathematics Partnership Committee**, CU Boulder, 2017–
- **Colloquium Committee**, CU Boulder, Department of Applied Mathematics, 2017–2018
- **Awards Committee**, CU Boulder, Department of Applied Mathematics, 2016–2017
- **Graduate Studies Committee**, UH, Department of Mathematics, 2014–2015
- **Gulf Coast Consortium for Theoretical and Computational Neuroscience**, UH/Rice University/Texas Medical Center, 2012–2016

- **Colloquium Committee**, UH, Department of Mathematics, 2012-2016
- **NETWORKS Seminar Committee**, UH, 2012–2016

Outreach

- **Association for Women in Math**, U Utah, alumnus mentor, 2016–
- **Summer Undergraduate Research Fellowship**, UH, professional development panelist, 2015
- **National Alliance for Doctoral Studies in the Mathematical Sciences**, mentor, 2014–
- **SIAM/AMS Student Chapter**, UH, professional development panelist, 2013–2016
- **Cougar and Houston Area Mathematics Program (CHAMP)**, UH, facilitating high school mathematics outreach program, 2013–2016