

ICMNS 2017

The 3rd International Conference on Mathematical Neuroscience

Hotel Boulderado, Boulder CO, May 30—June 2, 2017

PROGRAM

NSF

BURROUGHS WELLCOME FUND

siam

UNIVERSITY OF COLORADO 1876 LET YOUR LIGHT SHINE

Foreword

Welcome to Boulder!

The Third International Conference on Mathematical Neuroscience will be held at the Hotel Boulderado in Boulder, Colorado from May 30 to June 2, 2017. The event provides a forum for researchers to discuss current mathematical innovations emerging in neuroscience. The lectures will discuss new tools and methods for analyzing complex data sets and building rigorous mathematical models of brain function. A major aim of the conference is to attract and train young researchers on current methods in mathematical neuroscience. To fulfill this goal, there will be a tutorial component held the day before the main meeting. The topics discussed during the tutorial sessions and main meeting are relevant to scientific disciplines beyond neuroscience: including systems biology, economics, and ecology.

The meeting provides an opportunity for mathematicians to gain exposure to current research in neuroscience and communicate with neuroscientists. At the same time, it enables experimental neuroscientists to discuss current progress on understanding the dynamics and function of neural systems with mathematicians who develop new tools and methods to address present challenges. This conference will bring together leaders in applied mathematics and neuroscience that are developing new mathematical techniques for understanding high-dimensional data sets, building models to capture activity patterns and emergent computation, and working closely with experimentalists to address more targeted questions about brain function. Synergistic interactions between these topics emerge naturally during the meeting, helping us further understand the full complexity of the nervous system.

We are glad you are able to attend. The next ICMNS will be held in Europe during Summer 2019, so watch your email for future announcements!

Please share favorite moments at ICMNS 2017 on social media using the hashtag: **#icmns17**

Sincerely,
The Conference Chairs:
Zachary Kilpatrick, University of Colorado Boulder
Julijana Gjorgjieva, Max Planck Institute for Brain Research and Technical University of Munich
Robert Rosenbaum, University of Notre Dame

Committees

Program Committee

Asohan Amarasingham (CUNY)
Daniele Avitabile (U Nottingham)
Omri Barak (Technion)
Andrea Barreiro (SMU)
Dani Bassett (U Penn)
Amit Bose (NJIT)
Nicolas Brunel (U Chicago)
Pascal Chossat (U Nice)
Carina Curto (Penn State)
Suzanne Ditlevsen (U Copenhagen)
Brent Doiron (U Pittsburgh)
Gregory Faye (U Paul Sabatier)
Ila Fiete (U Texas)
Stefano Fusi (Columbia)
Chad Giusti (U Penn)
Toni Guillamon
(U Politècnica de Catalunya)
Boris Gutkin (ENS)
Kresimir Josic (U Houston)
Martin Krupa (INRIA Sophia Antipolis)
Carlo Laing (Massey University)
Guillaume Lajoie (U Washington)
Tim Lewis (UC Davis)
Cheng Ly (VCU)
Ruben Moreno-Bote (U Pompeu Fabra)
Srdjan Ostojic (ENS)
Roland Potthast (U Reading)
Horacio Rotstein (NJIT)
Wilhelm Stannat (TU Berlin)
Tatjana Tchumatchenko (Max Planck)
Taro Toyoizumi (RIKEN)
Martin Wechselberger (U Sydney)
Joel Zylberberg (CU School of Medicine)

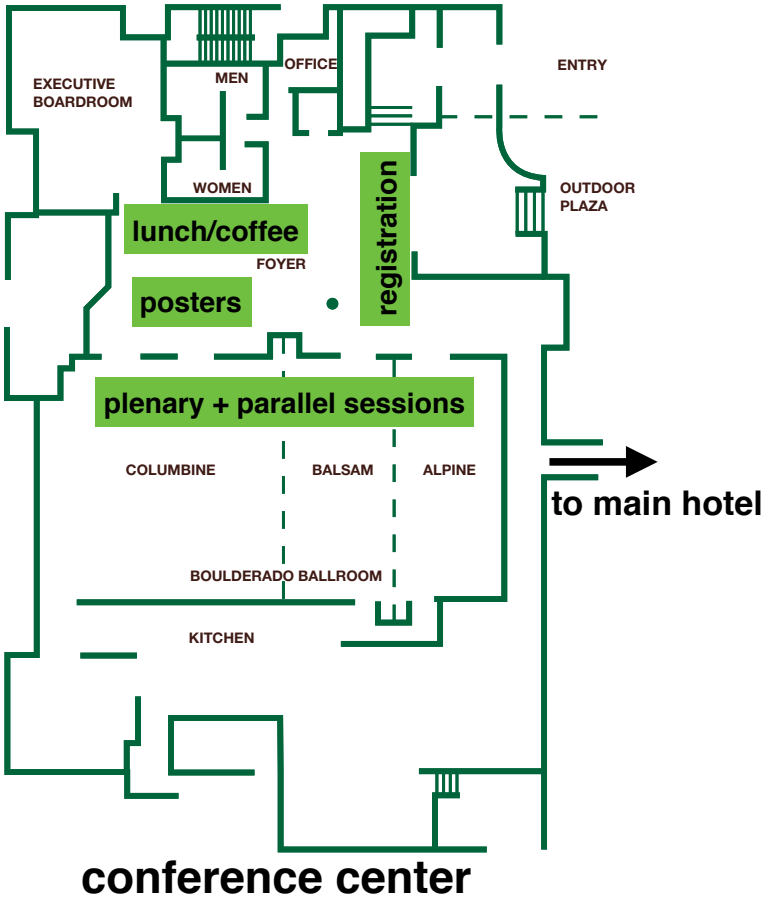
Advisory Committee

Paul Bressloff (U Utah)
Olivier Faugeras
(INRIA — Sophia Antipolis)
Steve Coombes (U Nottingham)
Romain Veltz
(INRIA — Sophia Antipolis)
Evelyn Buckwar
(Johannes Keplar Universitat Linz)

University of Colorado Boulder Applied Mathematics Staff

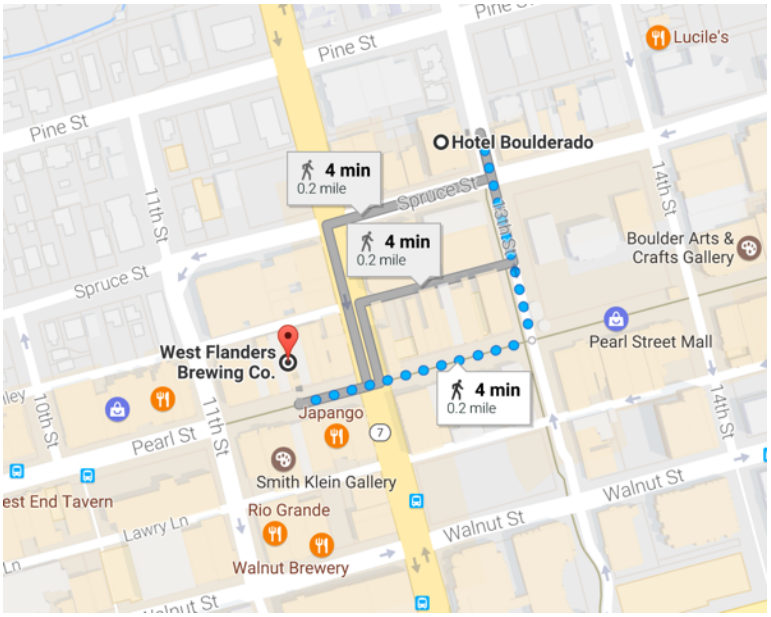
Mary Fentress
Desiree Holtz

Conference and Banquet Locations



Hotel Boulderado Conference Center
2115 13th St
Boulder, CO 80302
phone: 303-442-4344
http://www.boulderado.com/

WIFI Access Code
User: Hotel Boulderado
Password: historic



Banquet: June 1, 6:30pm
Drinks: 6:30-7:30pm
Dinner: 7:30pm—
*food and non-alcoholic drinks are covered, but you must buy your own alcohol

West Flanders Brewing Co.
1125 Pearl St
Boulder, CO 80302
phone: 303-447-2739

Schedule at a Glance

Tuesday, May 30: Tutorials

Morning Single-Track Tutorials:

9-10am: Paul Bressloff: Stochastic hybrid systems
10-10:30am: Break
10:30-11:30am: Joel Zylberberg: Information theory
11:30am-1pm: Lunch

Afternoon Parallel Tutorials:

1. Stochasticity and network dynamics (Chair: Kilpatrick)
1-2pm: Paul Bressloff: Stochastic hybrid systems
2-3pm: Brent Doiron: Neuronal variability in networks
3-3:30pm: Break
3:30-4:30pm: Stefano Fusi: Plasticity

2. Information theory & neural coding (Chair: Gjorgjieva)
Joel Zylberberg: Correlations & information
Sophie Deneve: Spike coding networks
Break
Sophie Deneve: Spike coding networks

Wednesday, May 31: Main Conference, Day 1 (Chair: Zachary Kilpatrick)

9-9:10am: Welcome
9:10-9:50am: Paul Bressloff (U Utah): Beyond the neural master equation — Stochastic hybrid neural networks
9:50-10:20am: Break
10:20-11:50am: Parallel Session 1
11:50am-1:10pm: Lunch
1:10-1:50pm: Ila Fiete (U Texas): How fast is neural winner-take-all when deciding between many options?
1:50-2:30pm: Stefano Fusi (Columbia): The importance of biological complexity in synaptic memory consolidation
2:30-3pm: Break
3-4:30pm: Parallel Session 2

Thursday, June 1: Main Conference, Day 2 (Chair: Julijana Gjorgjieva)

9-9:40am: Marla Feller (University of California Berkeley):
Wiring up a circuit to perform computations: development of direction selectivity
9:40-10:20am: Sophie Deneve (École Normale Supérieure): Efficient and robust adaptive learning in neural circuits
10:20-10:50am: Break
10:50am-12:20pm: Parallel Session 3
12:20-1:40pm: Lunch
1:40-2:20pm: Danielle Bassett (University of Pennsylvania):
A developmental arc of white matter supporting a growing diversity of brain dynamics
2:20-3pm: Peter Thomas (Case Western Reserve University): Defining the phase of a stochastic oscillator
3-5:30pm: Posters
6:30-10pm: Banquet at West Flanders Brewing Co.

Friday, June 2: Main Conference, Day 3 (Chair: Robert Rosenbaum)

9-9:40am: Nicolas Brunel (U Chicago): Minimal biophysical models of synaptic plasticity
9:40-10:10am: Break
10:10-11:40am: Parallel Session 4
11:40am-1pm: Lunch
1-1:40pm: Brent Doiron (U Pittsburgh): Watch this space (in balanced networks)
1:40-2:20pm: Taro Toyoizumi (RIKEN): A theory of how active behavior affects spontaneous activity and neural responses: neural gain modulation by closed-loop environmental feedback
2:20-2:50pm: Break
2:50-4:20pm: Parallel Session 5
4:20-4:40pm: Poster Awards and Farewell

Parallel Sessions

Wednesday, May 31: Main Conference, Day 1

Parallel Session 1 (10:20-11:50am)

Columbine: Stochastic dynamics and mean field methods (Chair: Horacio Rotstein, NJIT)

10:20-10:50am: **Helmut Schmidt**, D Avitabile, E Montbrió and A Roxin. Macroscopic response of quadratic integrate-and-fire neurons to oscillatory forcing

10:50-11:20am: **Sven Goedeke**, J Schuecker and M Helias. A dynamic mean-field approach for the largest Lyapunov exponent

11:20-11:50am: **Wilten Nicola** and SA Campbell. Bifurcations in piecewise smooth continuous mean-field models

Balsam: From data to models (Chair: Jean-Phillipe Thivierge, U Ottawa)

10:20-10:50am: **Yuwei Cui**, Y Yu, S Smith and S Ahmad. Presence of high order cell assemblies in mouse visual cortices during natural movie stimulation

10:50-11:20am: **Rodica Curtu**, S Wijeakumar, J Ambrose, and J Spencer. Model-based fMRI approach using dynamic neural fields

11:20-11:50am: **Leenoy Meshulam**, J Gauthier, C Brody, D Tank and W Bialek. Collective behavior of place and non-place neurons in (very) large hippocampal networks

Alpine: Spatiotemporal dynamics (Chair: Victor Matveev, NJIT)

10:20-10:50am: **Andrew Oster** and PC Bressloff. Laminar development of the primary visual cortex

10:50-11:20am: **Kathryn Hedrick**. Analysis of a hippocampal attractor network driven by conflicting external input

11:20-11:50am: **Daniele Avitabile**, M Desroches, and E Knobloch. Spatiotemporal canards in neural field equations

Parallel Session 2 (3-4:30pm)

Columbine: Stochastic dynamics and mean field methods (Chair: Cheng Ly, Virginia Commonwealth U)

3-3:30pm: **Danke Zhang**, C Zhang, and A Stepanyants. Order-to-chaos phase transition in recurrent networks operating at maximum capacity for storing sequences of network states

3:30-4pm: **Olivier Faugeras**, J Maclaurin and E Tanre. Coping with correlations in the analysis of the thermodynamic limit of neuronal networks

4-4:30pm: **Andrea Barreiro** and C Ly. When do correlations increase with firing rates?

Balsam: From data to models (Chair: Rodica Curtu, University of Iowa)

3-3:30pm: **Jonathan Schiefer**, C Lennartz, P Levan, J Hennig and S Rotter. Estimation of effective connectivity from fMRI signals based on zero-lag covariance

3:30-4pm: **Jean-Philippe Thivierge**. Beyond models of linear accumulation: Neural dynamics of decision making under uncertainty

4-4:30pm: **Andrea Ferrario**, R Merrison-Hort and R Borisyuk. A probabilistic model of neuronal connectivity in the Xenopus tadpole spinal cord: Network properties and functionality

Alpine: Spatiotemporal dynamics (Chair: Daniele Avitabile, U Nottingham)

3-3:30pm: **Carlo Laing**. Bumps in small-world networks

3:30-4pm: **Samuel Carroll** and PC Bressloff. Symmetric bifurcations in a neural field model for encoding the direction of spatial contrast gradients

4-4:30pm: **Victor Matveev**. Rapid buffer approximation for Ca^{2+} buffers with two binding sites

Thursday, June 1: Main Conference, Day 2

Parallel Session 3 (10:50am-12:20pm)

Columbine: Network connectivity and dynamics (Chair: Peter Thomas, Case Western Reserve)

10:50-11:20am: **Gabriel Koch Ocker**, K Josic, E Shea-Brown and M Buice. Linking structure and activity in nonlinear spiking networks

11:20-11:50am: **Christopher Ebsch** and R Rosenbaum. Amplification and suppression in weakly balanced networks

11:50am-12:20pm: **Anca Radulescu**. Effects of configuration on ensemble dynamics in a Wilson-Cowan network

Balsam: Neural coding (Chair: Andrea Barreiro, Southern Methodist University)

10:50-11:20am: **Alex Kunin** and V Itskov. Low-dimensional geometry of stimuli shapes the information content of a neural code

11:20-11:50am: **Mirjana Maras** and S Deneve. Sparse predictive coding in balanced spiking networks

11:50am-12:20pm: **Luca Mazzucato**, G La Camera and A Fontanini. Metastable dynamics drives anticipatory neural activity

Alpine: Oscillations and synchrony (Chair: Kathryn Hedrick, Southern Methodist University)
10:50-11:20am: **David Fox**, HG Rotstein and F Nadim. Neuromodulator-induced antiresonance
11:20-11:50am: **Nora Stack**, M Carskadon, D Barker and C Diniz Behn. Establishing a theoretical framework for the ultradian forced desynchrony protocol
11:50am-12:20pm: **Justyna Signerska-Rynkowska**, JE Rubin, J Touboul and A Vidal. Complex oscillations in a hybrid neuron model: bursting, spike-adding and chaos.

Friday, June 2: Main Conference, Day 3
Parallel Session 4 (10:10-11:40am)
Columbine: Network connectivity and dynamics (Chair: Anca Radulescu, SUNY New Paltz)
10:10-10:40am: **Francesca Mastrogiuseppe** and S Ostojic. From dynamics to computation in recurrent random networks with low-rank connectivity structure
10:40-11:10am: **Katherine Morrison**, C Parmelee, C Curto and S Moore. Predicting emergent sequences from network connectivity
11:10-11:40am: **Laureline Logiaco** and GS Escola. Thalamic modulation of cortical dynamics permits a massive reduction in neural resources for motor sequence generation

Balsam: Plasticity and learning (Chair: Joel Zylberberg, University of Colorado School of Medicine)
10:10-10:40am: **Guillaume Lajoie**, A Fairhall and E Fetz. Correlation-based model predicts efficacy of artificially-induced plasticity in motor cortex by a bidirectional brain-computer interface
10:40-11:10am: **Aditya Gilra** and W Gerstner. Local, online and Lyapunov-stable learning of non-linear dynamics in a recurrent spiking neural network
11:10-11:40am: **Callie Federer** and J Zylberberg. A self-organizing memory network

Alpine: Statistics of stochastic models (Chair: TBA)
10:10-10:40am: **Deena Schmidt**, R Galan and P Thomas. Dimension reduction for stochastic conductance based neural models with time scale separation
10:40-11:10am: **Jacob Østergaard**, M Kramer and UT Eden. Can Generalized Linear Models describe both variability and intrinsic dynamics of Izhikevich neurons with noise?
11:10-11:40am: **André Longtin**, R Naud, and A Payeur. Tapering of active dendrites can enhance signal transmission through noise-gated stochastic resonance

Parallel Session 5 (2:50-4:20pm)
Columbine: Network connectivity and dynamics (Chair: Gabriel Koch Ocker, Allen Institute)
2:50-3:20pm: **Yury Sokolov** and JE Rubin. Multistate bootstrap percolation model of bursting in the pre-Botzinger complex
3:20-3:50pm: **Christopher Kim** and CC Chow. Supervised learning in spiking neural networks with rate chaos
3:50-4:20pm: **Jennifer Crodelle**, G Kovacic and D Cai. Synchrony among synaptically and electrically connected neurons in the cortex

Balsam: Plasticity and learning (Chair: Taro Toyoizumi, RIKEN Brain Science Institute)
2:50-3:20pm: **Ulises Pereira** and N Brunel. Inferred learning rules From IT cortex Are optimal for memory storage and lead to graded and time-varying neural representations
3:20-3:50pm: **Mauro Miguel Monsalve Mercado** and C Leibold. Feed-forward learning of grid cells: Universality and biological implementations
3:50-4:20pm: **Chiara Gastaldi**, S Muscinelli, and W Gerstner. Systematic study of synaptic consolidation models using phase-plane analysis

Alpine: Statistics of stochastic models (Chair: Deena Schmidt, U Nevada Reno)
2:50-3:20pm: **Catalina Vich Llompart**, A Guillamon, RP Sastre, and AE Teruel Aguilar. A first approach to estimate synaptic conductances in the spiking regime
3:20-3:50pm: **Wilhelm Braun** and A Longtin. Correlation-decorrelation transitions in multidimensional stochastic neuron models
3:50-4:20pm: **Anna Kutschireiter**, SC Surace, H Sprekeler and JP Pfister. The neural particle filter

Posters
1. Cesar Uribe. The dynamical and structural properties of a random neural network are affected by its directed assortativity profiles
2. Gecia Bravo Hermsdorff and Lee Gunderson. Extending spectral sparsification of graphs
3. Ryan Pyle. Supervised Learning Trained by Rewarded Exploration: A learning rule for reservoir computing
4. Michael Kordovan. Consequences of network topologies for dynamical stability of networks and their correlations

5. Chi Zhang. Structural and dynamic properties of neural networks with robust associative memory recall in the presence of fluctuations in neuron firing
6. Cody Baker. Inferring latent variability in neural populations
7. Rodrigo Felipe de Oliveira Pena. Determination of the spike-train second-order power spectrum statistics in heterogeneous spiking networks
8. Argha Mondal. Fractional order excitable neural system with bidirectional coupling
9. Epaminondas Rosa. Period doubling bifurcation transitions in synchronous model neurons
10. Jacob Duncan. Breaking the vicious limit cycle: Addiction relapse-recovery as a fast-slow dynamical system
11. Randolph Leiser. Frequency Response Alternating Map: A mutually forced approach to resonant networks
12. Sorinel Oprisan. Predicting phase-locked modes with the generalized phase response curve
13. Casey Diekman. Entrainment maps: A new tool for understanding circadian oscillators
14. Cecilia Diniz Behn. A map-based approach to understanding bifurcations in a model of sleep-wake behavior
15. Fatemeh Bahari. Estimation of hidden dynamics in nonlinear systems for predicting sleep-wake states
16. Yogatheesan Varatharajah. Interictal seizure localization using unsupervised clustering and Bayesian filtering
17. Sarah Marzen. Weak universality in sensory tradeoffs
18. Amirali Farokhniaee. Deep brain stimulation driven synaptic depletion is a robust phenomenon independent of synapse type
19. Ariadne Costa. Correlations induced by depressing synapses in quenched critically self-organized networks
20. Pascal Helson. A simple spiking neuron model based on stochastic STDP
21. Ehsan Mirzakhalili. Synaptic deficiencies and robustness of excitatory neuronal networks
22. Eric Yeh. Inducing rule-like learning in connectionist architectures
23. Olivia Gozel. A functional role for the switch from excitation to inhibition in neurogenesis
24. Emily Stone. Effect of short-term synaptic plasticity on information processing in hippocampal interneurons
25. Rosangela Follmann. Functional connectivity in a motor control center using correlation analysis
26. Helga Mazyar. A computational account of the development of a preferred retinal locus
27. Lindsay Fields. Developing a predictive model for compulsivity in individuals with OCD
28. Venkat Ramaswamy. An algorithmic question concerning the experimental interrogation of neural circuits
29. James Riehl. Energy landscapes of the brain during wakefulness and general anesthesia
30. Sorinel Oprisan. Nonlinear dynamics analysis of optogenetic data
31. Ning Mei. Optimizing parameters used in a signal processing approach to detect spindles
32. Matthew Moye. Data assimilation and electrophysiological modeling of mammalian circadian clock neurons
33. Kathryn McClain. Decoding 2D environment from dCA1 while learning a spatial memory task
34. Sorinel Oprisan. Computational modeling of hippocampus lesions during time perception
35. Asohan Amarasingham. Calibrated nonparametric analysis of monosynaptic interactions from extracellular spike trains
36. Songting Li. The characterization of hippocampal interneurons — a time delayed mutual information approach
37. Kathleen Champion. Comparing dynamical models for brain-wide cortical activity
38. Francois G. Meyer. Learning the dynamics of epileptogenesis
39. Rodica Curtu. Evidence accumulation and dynamic mechanisms of percept switching in auditory streaming
40. Anirban Nandi. Phasic response motifs are optimal for persistent detections
41. Sarah Marzen. Utilizing local discrete structure for perceptual distortion in natural images
42. Benoit Duchet. Analysis of the effects of deep brain stimulation in a mathematical model of coupled excitatory and inhibitory neural populations
43. Thomas Peters. Geometry and topology for discrete dynamics of neurodevelopment
44. Hannah Bos. Ratio of slow and fast synaptic currents regulates synchrony of population rate activity in a spiking layered cortical network model
45. Grégory Dumont. Macroscopic phase-resetting curve of spiking neural networks: Theory and application.
46. Laureline Logiaco. A dynamic theory for populations of adapting non-linear neurons explains log-normal instantaneous firing rate distributions and disambiguates mean vs. variance-driven firing
47. Pavel Alejandro Flores. A lateral inhibition model of the Hermann grid illusion beyond Baumgartner's theory
48. Cheng Ly. A theoretical framework for analyzing coupled neuronal networks: Application to the olfactory system
49. Ho Ka Chan. Odor processing in a biophysical model of the early olfactory system of honeybees
50. Abed Ghanbari. Modeling dispersion improves decoding of population neural responses
51. Ho Ka Chan. Firing probability for a noisy LIF neuron receiving arbitrary external currents
52. Jennifer Creaser. Mathematical modeling of noise-induced escape in networks of coupled bistable units
53. Romain Veltz. Quasi-synchronization in a stochastic spiking neural network
54. Ryosuke Hosaka. Strange neuronal responses to fluctuating inputs
55. Rainer Engelken and Fred Wolf. Dimensionality and entropy rate of chaotic rate network dynamics
56. Evelyn Buckwar. Efficent numerical integration and nonlinear filtering of a stochastic Jansen and Rit model
57. Gillian Queisser. Ultra-structural simulations of electro-chemical signals through dendritic spines
58. Tzyy-Leng Horng. Cable type model and its application on action potential propagation in a myelinated axon
59. Cris Garrish. Simulated spatial dependence in action potential propagation