

Louis Kang

Redwood Center for Theoretical Neuroscience
University of California, Berkeley
louis.kang@berkeley.edu
https://louiska.ng

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POSITION

Miller Postdoctoral Fellow

2017–2020

University of California, Berkeley, USA

Host departments: Physics and Helen Wills Neuroscience Institute

Host faculty: Mike DeWeese

RESEARCH STATEMENT

Human cognition ultimately emerges from sophisticated computations performed by networks of neurons. I use and develop theoretical tools to investigate how our brains make sense of and respond to our dynamic environments. In particular, I am pursuing a unified understanding for how the hippocampus and entorhinal cortex allow us to form memories and navigate through space.

EDUCATION

MD, Perelman School of Medicine

2017

University of Pennsylvania, Philadelphia, USA

Research elective with Vijay Balasubramanian in theoretical neuroscience

PhD, Department of Physics & Astronomy

2015

University of Pennsylvania, Philadelphia, USA

Thesis advisor: Tom Lubensky

Thesis title: *Chirality and its spontaneous symmetry breaking in two liquid crystal systems*

AB in Chemistry and Physics and Mathematics *summa cum laude*

2009

Harvard University, Cambridge, USA

VISITING POSITION

Visiting Scientist

Summer 2019

RIKEN Center for Brain Science, Wako, Japan

Host faculty: Taro Toyozumi

PUBLICATIONS

*equal contribution †corresponding author

8. **Kang L[†]**, DeWeese MR. Replay as wavefronts and theta sequences as bump oscillations in a grid cell attractor network. *eLife* 8, e46351 (2019). doi:10.7554/eLife.46351.
7. **Kang L[†]**, Balasubramanian V. A geometric attractor mechanism for self-organization of entorhinal grid modules. *eLife* 8, e46687 (2019). doi:10.7554/eLife.46687.

6. **Kang L[†]**, Lubensky TC. Chiral twist drives raft formation and organization in membranes composed of rod-like particles. *Proc Natl Acad Sci USA* 114, E19 (2017). doi:10.1073/pnas.1613732114.
5. **Kang L[†]**, Gibaud T, Dogic Z, Lubensky TC. Entropic forces stabilize diverse emergent structures in colloidal membranes. *Soft Matter* 12, 386 (2016). doi:10.1039/C5SM02038G.
4. Davidson ZS*, **Kang L***, Jeong J*,[†] Still T, Collings PJ, Lubensky TC, Yodh AG. Chiral structures and defects of lyotropic chromonic liquid crystals induced by saddle-splay elasticity. *Phys Rev E* 91, 050501 (2015). doi:10.1103/PhysRevE.91.050501.
3. Jeong J*,[†] **Kang L***, Davidson ZS, Collings PJ, Lubensky TC, Yodh AG. Chiral structures from achiral liquid crystals in cylindrical capillaries. *Proc Natl Acad Sci USA* 112, E1837 (2015). doi:10.1073/pnas.1423220112.
2. Idema T, Dubuis JO, **Kang L**, Manning ML, Nelson PC, Lubensky TC, Liu AJ[†]. The syncytial *Drosophila* embryo as a mechanically excitable medium. *PLOS ONE* 8, e77216 (2013). doi:10.1371/journal.pone.0077216.
1. Heo M, **Kang L**, Shakhnovich EI[†]. Emergence of species in evolutionary “simulated annealing”. *Proc Natl Acad Sci USA* 106, 1869 (2009). doi:10.1073/pnas.0809852106.

GRANTS, AWARDS, AND HONORS

Collaborative Research Travel Grant Burroughs Wellcome Fund Project role: PI Project title: <i>Complementary input pathways enhance associative memory in a model of CA3</i>	2019–2020
Travel Award Computational Neuroscience Meeting (CNS*2018)	2018
Miller Research Fellowship University of California, Berkeley	2017–2020
Mary Ellis Bell Prize University of Pennsylvania, Perelman School of Medicine “This prize is given to a student in the School of Medicine who is engaged in noteworthy research in any field related to medicine.”	2016
Werner Teutsch Memorial Prize University of Pennsylvania, Department of Physics & Astronomy “Awarded annually to the graduate student who, by his or her performance in the first year courses, shows the most promise for outstanding achievement in research.”	2012
Medical Scientist Training Program National Institutes of Health (USA), awarded through the University of Pennsylvania	2009–2017
Phi Beta Kappa Harvard University	2009

CONFERENCE PRESENTATIONS †talk

Society for Neuroscience Meeting , Chicago, USA	2019
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<i>Replay as wavefronts and theta sequences as bump oscillations in a grid cell attractor network</i>	
Bernstein Conference , Berlin, Germany	2018
<i>Replay arises naturally as a traveling wavefront in an entorhinal attractor network[‡]</i>	
Computational Neuroscience Meeting (CNS*2018) , Seattle, USA	2018
<i>A geometric attractor mechanism for the self-organization of entorhinal grid modules[‡]</i>	
Interdisciplinary Navigation Symposium (iNAV) , Mont-Tremblant, Canada	2018
<i>A geometric attractor mechanism for the self-organization of entorhinal grid modules[‡]</i>	
American Physical Society March Meeting , Los Angeles, USA	2018
<i>Self-organization of entorhinal grid modules through commensurate lattice relationships[‡]</i>	
Computational and Systems Neuroscience (Cosyne) , Denver, USA	2018
<i>Self-organization of entorhinal grid modules through commensurate lattices</i>	
American Physical Society March Meeting , New Orleans, USA	2017
<i>Membrane rafts stabilized by chiral liquid crystal correction to bare interfacial tension[‡]</i>	
Computational and Systems Neuroscience (Cosyne) , Salt Lake City, USA	2017
<i>Coupling between attractor networks naturally generates a discrete grid cell hierarchy</i>	
Gordon Research Conference & Seminar on Liquid Crystals , Biddeford, USA	2015
<i>Roles of entropy and chirality in depletion-induced colloidal membranes[‡]</i>	
American Chemical Society Colloid & Surface Science Symposium , Philadelphia, USA	2014
<i>A theory for depletion-induced colloidal membranes[‡]</i>	
American Physical Society March Meeting , Denver, USA	2014
<i>A theory for depletion-induced colloidal membranes[‡]</i>	
IAS Program on Frontiers of Soft Matter Physics , Hong Kong	2014
<i>A theory for depletion-induced colloidal membranes</i>	
American Physical Society March Meeting , Baltimore, USA	2013
<i>Mitotic wavefronts mediated by mechanical signaling in early Drosophila embryos[‡]</i>	
EXTERNAL SEMINARS —————	
University of Tokyo , Japan	2019
Yuji Ikegaya Group	
<i>Replay as wavefronts and theta sequences as bump oscillations in a grid cell attractor network</i>	
Ludwig-Maximilians-Universität München , Germany	2018
Bernstein Center for Computational Neuroscience Munich	
<i>Modules (and phase precession and replay) in continuous attractor models of grid cells</i>	
University College London , UK	2018
Institute for Behavioural Neuroscience	
<i>Replay arises naturally as a traveling wavefront in an entorhinal attractor network</i>	
École Normale Supérieure , Paris, France	2017
Group for Neural Theory	
<i>Self-organization of entorhinal grid modules through commensurate lattice relationships</i>	

Institut Curie , Paris, France Pierre Sens Group <i>Chiral twist drives raft formation and organization in membranes composed of rod-like particles</i>	2017
University College London , UK Gatsby Computational Neuroscience Unit <i>Coupling between attractor networks naturally generates a discrete grid cell hierarchy</i>	2016
University of California, Los Angeles , USA Center for Biological Physics <i>Chiral twist drives raft formation and organization in membranes composed of rod-like particles</i>	2016

TEACHING

Teaching Assistant University of Pennsylvania Modern physics, wave phenomena, electromagnetism, physics laboratory	2011–2015
Teaching Fellow Harvard University Organic chemistry, linear algebra	2006–2007

CLINICAL SERVICE

Medical Volunteer Project Homeless Connect Providing medical care at homeless services events in San Francisco	2018–present
Medical Student Volunteer United Community Clinics Provided medical care at a free health clinic in Philadelphia	2010–2013

REFERENCES

Mike DeWeese <i>Postdoctoral advisor</i> University of California, Berkeley Redwood Center for Theoretical Neuroscience deweese@berkeley.edu	Tom Lubensky <i>PhD advisor</i> University of Pennsylvania Department of Physics & Astronomy tom@physics.upenn.edu
Vijay Balasubramanian <i>Research mentor</i> University of Pennsylvania Department of Physics & Astronomy vijay@physics.upenn.edu	Taro Toyozumi <i>Research mentor</i> RIKEN Center for Brain Science Neural Adaptation and Computation Group taro.toyoizumi@riken.jp