Todd R. Gingrich

Curriculum Vitae

Physics of Living Systems Fellow
Massachusetts Institute of Technology
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Education

University of California, Berkeley — Graduation: 2015
Ph.D. in Chemistry (Theoretical) — **Hertz Fellow**
Research Advisor: Prof. Phillip Geissler — **NSF Fellow**
Thesis: *Two Paths Diverged: Exploring Trajectories, Protocols, and Dynamic Phases*

University College, Oxford University — Graduation: 2010
M.Sc. (By Research) Physical and Theoretical Chemistry — **Rhodes Scholar**
Research Advisor: Prof. Mark Wilson
Thesis: *Simulating Surface Charge Effects in Carbon Nanotube Templated Ionic Crystal Growth*

California Institute of Technology — Graduation: 2008
B.S. Chemistry with Honors — GPA: 3.9
Research Advisor: Prof. Nathan S. Lewis

Peer-Reviewed Publications

16. **Gingrich TR** and Horowitz JM. "Fundamental Bounds on First Passage Time Fluctuations for Currents." *Phys. Rev. Lett.*, **119**, 170601 (2017)

15. Bisker G, Polettini M, **Gingrich TR**, Horowitz JM. "Hierarchical Bounds on Entropy Production Inferred from Partial Information." *J. Stat. Mech. Theor. Exp.*, 093210 (2017)

14. Horowitz JM and **Gingrich TR**. "Proof of the Finite-Time Thermodynamic Uncertainty Relation for Steady-State Currents." *Phys. Rev. E* **96**, 020103(R) (2017) [**Editor's Suggestion**]

13. Zakine R, Solon A, **Gingrich TR**, van Wijland F, "Stochastic Stirling engine operating in contact with active baths.", *Entropy*, **19(5)**, 193 (2017)

12. **Gingrich, TR**, Rotskoff GM, Horowitz JM, "Inferring dissipation from current fluctuations.", *J. Phys. A*, **50**, 184004 (2017)

11. **Gingrich, TR**, Rotskoff GM, Crooks GE, Geissler PL. "Near-optimal protocols in complex nonequilibrium transformations", *Proc. Natl. Acad. Sci. USA*, **113(37)**, 10263 (2016)

10. **Gingrich, TR**, Horowitz JM, Perunov N, England JL. "Dissipation bounds all steady-state current fluctuations", *Phys. Rev. Lett.*, **116**, 120601 (2016)

9. **Gingrich, TR** and Geissler, PL. "Preserving correlations between trajectories for efficient path sampling", *J. Chem. Phys.*, **142**, 23 (2015) [**Editor's Choice**]

8. **Gingrich, TR**, Rotskoff GM, Vaikuntanathan S, Geissler PL. "Efficiency and large deviations in time-asymmetric stochastic heat engines", *New J. Phys.* **16**, 102003 (2014) [**Fast Track Communication**]

7. **Gingrich, TR**, Vaikuntanathan S, Geissler PL. "Heterogeneity-induced large deviations in activity and (in some cases) entropy production", *Phys. Rev. E* **90**, 042123 (2014)
6. Vaikuntanathan S, **Gingrich TR**, Geissler PL. "Dynamic phase transitions in simple driven kinetic networks", *Phys. Rev. E* **89**, 062108 (2014)
5. **Gingrich TR** and Wilson M. "The control of inorganic nanotube morphology using an applied potential", *J. Phys. Cond. Matt.* **23**, 135306 (2011)
4. **Gingrich TR** and Wilson M. "On the Ewald summation of Gaussian charges for simulation of metallic surfaces", *Chem. Phys. Lett.* **500**, 178 (2010)
3. Katz JE, **Gingrich TR**, Santori EA, Lewis NS. "Combinatorial synthesis and high-throughput photopotential and photocurrent screening of mixed-metal oxides for photoelectrochemical water splitting", *Energy Environ. Sci.* **2**, 103 (2009)
2. Thallapally PK, Dobrzanska L, **Gingrich TR**, Wirsig TB, Barbour LJ, Atwood JL. "Acetylene absorption and binding in a nonporous crystal lattice", *Angew. Chem. Int. Ed.* **45**, 6506 (2006)
1. Smith GP and **Gingrich TR**. "Hydroxyapatite chromatography of phage-display virions", *BioTechniques* **39**, 879 (2005)

Patent

Lewis NS, Katz JE, and **Gingrich, TR**. "High-throughput screening and device for photocatysts", US Patent 9,126,175 B2, 2015.

Awards and Recognition

Physics of Living Systems Fellowship, MIT (2015)
Outstanding Graduate Student Instructor, UC Berkeley (2013)
Dan Lucas Book Prize, UC Berkeley Physical Chemistry Top First Year (2011)
George W. Housner Student Discovery Fund Recipient, Caltech (2008)
Richard P. Schuster Chemistry Prize, Caltech (2008)
Fannie and John Hertz Foundation Graduate Fellowship (2008)
National Science Foundation Graduate Research Fellowship (2008)
Rhodes Scholarship (2008)
Robert L. Noland Leadership Award, Caltech (2007)
Amgen Scholars Summer Research Fellowship (2007)
California Institute of Technology Upperclass Merit Award (2005-2008)
Robert C. Byrd Honors Scholarship (2004-2008)

Invited Presentations

- *Dissipation-based uncertainty bounds for currents*, Large deviation theory in statistical physics: Recent advances and future challenges, ICTS, Bangalore, India, September 14, 2017.
- *Dynamical fluctuations in Markov processes - A Primer on Stochastic Thermodynamics, Fluctuation Theorems, and Large Deviations* [Three Pedagogical Lectures], Igert Summer Institute, Brandeis University, Waltham, MA, June 5-7, 2017.
- *Sampling low-dissipation protocols*, Statistical Mechanics//Machine Learning, Berkeley, CA, January 12, 2017.

- *Nonequilibrium fluctuations in molecular machines: The thermodynamic cost of reliability*, New York University Chemistry Department, December 19, 2016.
- *Nonequilibrium fluctuations in molecular machines: The thermodynamic cost of reliability*, Stanford University Chemistry Department, December 8, 2016.
- *Nonequilibrium fluctuations in molecular machines: The thermodynamic cost of reliability*, Columbia University Chemistry Department, November 29, 2016.
- *Nonequilibrium fluctuations in molecular machines: The thermodynamic cost of reliability*, UCSB Chemistry Department, November 15, 2016.
- *Nonequilibrium fluctuations in molecular machines: The thermodynamic cost of reliability*, Northwestern Chemistry Department, October 21, 2016.
- *Dissipation Bounds All Steady-State Current Fluctuations*, Boston University CMT/Biophysics Seminar, March 8. 2016.
- *Preserving Correlations Between Trajectories for Efficient Path Sampling*, American Physical Society March Meeting, JCP Editor's Choice Session, March 14, 2016.
- *Dynamic Fluctuations in Cyclic Processes*, Modeling and Inference from Single Molecules to Cells, Mathematical Biosciences Institute, Columbus, Ohio, February 12, 2016.
- *Large Dynamic Fluctuations in Cyclic Processes*, Large Deviation Theory in Principle and Practice, Princeton Center for Theoretical Science, November 17, 2015.
- *Preserving Correlations Between Trajectories for Efficient Path Sampling*, Chemistry & Physics of Liquids Gordon Research Conference, Holderness School, August 6, 2015 [**Poster Prize Short Talk**]
- *Efficient Path Sampling of Ising Dynamics for Identifying Low-dissipation Protocols*, Statistical Mechanics and Computation of Large Deviation Rate Functions, ENS de Lyon, France, June 16, 2015.
- *Large Dynamical Fluctuations in Cyclical Kinetic Processes*, Princeton Biophysics Symposium, December 5, 2014.
- *Large Deviations and Two-dimensional Rate Functions*, Workshop on Large Deviations in Statistical Physics, NITheP, Stellenbosch, South Africa, July 11, 2014.

Contributed Presentations

- *The thermodynamic cost of reliability*, Stat Mech Meeting Poster Session, Berkeley, CA, January 13, 2017.
- *Dissipation Bounds All Steady-State Current Fluctuations*, Special Stat Mech Seminar, Berkeley, CA, May 16, 2016.
- *Low Dissipation in Nonequilibrium Control: Sampling the Ensemble of Efficient Protocols*, American Physical Society March Meeting, March 17, 2016.
- *Dissipation Bounds All Steady-State Current Fluctuations*, Mini Stat Mech Meeting Poster Session, Berkeley, CA, January 8, 2016.
- *Dynamic Phase Transitions in Driven Cyclic Kinetic Networks*, American Physical Society March Meeting, March 2014.
- *Dynamic Phase Transitions in Driven Kinetic Networks*, Mini Stat Mech Meeting Breakout Session, Berkeley, CA, January 2014.
- *Dynamic Phase Transitions in Driven Kinetic Networks*, Chemistry and Physics of

Liquids, Gordon Research Conference, August 2013.

- *Dynamic Phase Transitions in Simple Kinetic Models*, Statistical Mechanics Seminar, College of Chemistry, Berkeley, CA, April 12, 2013.
- *Toward Dynamical Design: Path Sampling Methods for Seeking Fast Rates in Large Design Spaces*, Mini Stat Mech Meeting Poster Session, Berkeley, CA, January 2013.
- *Extended Ensemble Path Sampling*, Boulder School for Condensed Matter Poster Session, Boulder, CO, July 2012.
- *Driving Complex Systems Toward Assembly*, Graduate Research Conference, College of Chemistry, Berkeley, CA, March 2012.
- *Extended Ensemble Path Sampling for Identifying Optimal Out-of-Equilibrium Protocols*, Mini Stat Mech Meeting Poster Session, Berkeley, CA, January 2012. [**2nd Place Poster Prize Competition**]

Teaching Experience

Graduate Student Instructor, College of Chemistry, University of California, Berkeley

Chem 1A: General Chemistry, Fall 2010

Chem 120B: Physical Chemistry, Spring 2012
[**Outstanding Graduate Student Instructor Award**]

Chem 220B: Advanced Statistical Mechanics, Spring 2013

Service

Statistical Mechanics Seminar Series Organizer, UC Berkeley College of Chemistry, 2012-2015 (weekly)
District 15 Rhodes Scholar Selection Committee Member, 2013-2015
Reviewer for *Phys. Rev. Lett.*, *J. Phys. Chem.*, *J. Chem. Phys.*, *Phys. Rev. E*, *J. Stat. Phys.*, *J. Stat. Mech. Theor. Exp*, *J. Phys. A*, and *EPL*

Computing Experience

C, C++, Python, Mathematica, Matlab, MPI, Bash, LaTeX