

BRIAN SWINGLE

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WORK EXPERIENCE

University of Maryland, College Park

July 2017 – Present

Assistant Professor

- Member of the Condensed Matter Theory Center, the Joint Center for Quantum Information and Computer Science, and the Maryland Center for Fundamental Physics
- Principal Investigator in the It From Qubit Simons Collaboration

Harvard University Department of Physics

2016 – 2017

Post-doctoral Fellow:

- One-year transitional post-doc; joint with MIT and Brandeis

It From Qubit Simons Collaboration

2015 – 2017

It From Qubit Fellow

- Member of the recently formed Simons Collaboration aiming to understand the fundamental physics of matter and geometry using quantum information
- Collaboration partly based on ideas, e.g. geometry from entanglement, that I helped pioneer

Stanford University Department of Physics

2014 – 2016

Post-doctoral Fellow:

- Joint appointment with condensed matter theory, quantum information theory, and high energy theory groups

Harvard University Department of Physics

2011 – 2014

Post-doctoral Fellow:

- Simons Fellow
- Member of condensed matter theory group

MIT Department of Physics

2006 – 2011

Teaching Assistant:

- Designed course material, taught weekly recitations, provided private tutoring, and held weekly office hours
- Received excellent reviews for all courses taught

MIT Department of Physics

2008 – 2011

General Exam Tutor:

- Assisted graduate students in preparing for general exams
- Designed intensive review curricula for MIT Physics general exams
- Customized private review curricula for special needs students

MIT Department of Physics**2007 – 2011****Writing Mentor:**

- Mentored physics undergraduates in quantum mechanics
- Led group discussion sessions, mediated the peer review process, reviewed student papers and provided guidance on science writing and technical content

Georgia Tech Department of Mathematics**2003-2005****Teaching Assistant:**

- Taught weekly recitations and held office hours
- Courses taught: introductory and advanced calculus

EDUCATION

Massachusetts Institute of Technology**2005 – 2011**

- PhD in Theoretical Condensed Matter Physics

Georgia Institute of Technology**2001 – 2005**

- B.S. with Highest Honors in Physics

PROFESSIONAL ACTIVITIES & AWARDS

Seminars

- Quantum Science Gordon Research Conference, Stonehill College
 - It From Qubit Summer School, Perimeter Institute
 - Copenhagen
 - Harvard
 - MIT **2016**
 - UCLA
 - Johns Hopkins
 - University of Maryland
 - Stanford
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- Fundamental Bounds Workshop, Stanford
 - APS March Meeting
 - Aspen Center for Physics
 - Whaley group, Berkeley
 - Hamiltonian Complexity Reunion, Simons Center, Berkeley **2015**
 - Simons Symposium, Puerto Rico
 - “Closing the entanglement gap”, KITP
 - MIT
 - “Topological phases of matter, quantum field theory and quantum information school”, National Taiwan University

<ul style="list-style-type: none"> ▪ Texas A&M ▪ “Physics of the Universe Summit”, New York ▪ University of British Columbia ▪ Stanford ▪ Simons Center for the Theory of Computation, Berkeley ▪ University of California, San Diego ▪ Georgia Institute of Technology 	2014
<ul style="list-style-type: none"> ▪ Los Alamos National Lab ▪ Cornell University ▪ “Holography: from Gravity to Quantum Matter”, Newton Institute, Cambridge ▪ “Topological Phases of Matter” SCGP, Stony Brook ▪ “CAP 2013”, Montreal ▪ “Entanglement and Emergence II”, Perimeter Institute For Theoretical Physics ▪ APS March Meeting ▪ Quantum Hamiltonian Complexity Workshop, Berkeley ▪ “Quantum Entanglement”, Simons Symposium, St. John ▪ University of Chicago 	2013
<ul style="list-style-type: none"> ▪ University of Cologne ▪ Perimeter Institute for Theoretical Physics ▪ “Entanglement, RG flows, and holography”, Ann Arbor ▪ Stanford University ▪ University of British Columbia ▪ Stony Brook, Simons Fellows Symposium ▪ APS March Meeting, Symposium on Fractional Topological Insulators 	2012
<ul style="list-style-type: none"> ▪ Perimeter Institute for Theoretical Physics ▪ California Institute of Technology ▪ Aspen Center for Physics, Winter Conference on Strongly Correlated Systems and Gauge/Gravity Duality 	2011
<ul style="list-style-type: none"> ▪ Station Q ▪ Perimeter Institute for Theoretical Physics ▪ Harvard University ▪ Boulder Summer School, Condensed Matter Physics 	2010
<ul style="list-style-type: none"> ▪ Perimeter Institute for Theoretical Physics 	2009
<ul style="list-style-type: none"> ▪ University of Washington, Research Experience for Undergraduates Program 	2004
<ul style="list-style-type: none"> ▪ DAMOP Annual Meeting 	2003

Awards

- DARPA Riser 2015
- Block Award for “an outstanding young physicist”, Aspen Center for Physics
- Presidential Fellowship, MIT
- Hitohiro Fukuyo Memorial Scholarship, Georgia Tech
- Outstanding Physics Undergraduate Award, Georgia Tech
- Winner of American Physical Society Research Competition, Atomic, Molecular, and Optical Physics
- Presidential Research Fellowship, Georgia Tech

LEADERSHIP & SERVICE

American Physical Society **2009 - Present**

Physical Review Referee

- Peer-review journal articles for publication

MIT Condensed Matter Informal Seminar **2010 – 2011**

Organizer

- Responsible for recruiting speakers for weekly seminar series
- Maintain seminar website and mailing list

MIT Physics Graduate Student Council **2008 – 2011**

Condensed Matter & Colloquium Committee Representative

- Advocate for general exam reform
- Assist in organizing speakers for monthly lunch talks and weekly colloquiums

Physics Forums **2005 – Present**

Forum Member, Science Advisor, and Homework Helper

- Longtime member of online physics community
- Acknowledged as a skilled science advisor and tutor
- Continue to answer questions ranging from solid state physics and quantum mechanics to string theory and gravity

PUBLICATIONS

Swingle B, McGreevy J. Mixed s-sourcery: Building many-body states using bubbles of Nothing. *arXiv:1607.05753* (submitted to Phys. Rev. B)

Yao N, Grusdt F, Swingle B, Lukin M, Stamper-Kurn D, Moore J, Demler E. Interferometric Approach to Probing Fast Scrambling. *arXiv:1607.01801* (submitted to Phys. Rev. Lett.)

Almheiri A, Dong X, Swingle B. Linearity of Holographic Entanglement Entropy *arXiv:1606.04537* (submitted JHEP)

Roberts D, Swingle B. Lieb-Robinson and the butterfly effect. *arXiv:1603.09298* (accepted to Phys. Rev. Lett.)

Swingle B, Bentsen G, Schleier-Smith M, Hayden P. Measuring the Scrambling of Quantum Information *arXiv:1602.06271* (submitted to Phys. Rev. Lett.)

Swingle B, McGreevy J, Xu Shenglong. Renormalization Group Circuits for Gapless States. Phys. Rev. B 93, 205159 (2016) *arXiv:1602.02805*

Brown A, Roberts D, Susskind L, Swingle B, Zhao Y. Complexity, action, and black holes. Phys. Rev. D 93, 086006 (2016) *arXiv:1512.04993*

Brown A, Roberts D, Susskind L, Swingle B, Zhao Y. Complexity equals action. Phys. Rev. Lett. 116, 191301 (2016) *arXiv:1509.07876*

Swingle B, McGreevy J. Area law for gapless states from local entanglement thermodynamics. Phys. Rev. B 93, 205120 (2016) *arXiv:1505.07106*

Czech B, Hayden P, Lashkari N, Swingle B. The Information Theoretic Interpretation of the Length of a Curve. JHEP 2015:157 *arXiv:1410.1540*

Kravec SM, McGreevy J, Swingle B. All-fermion electrodynamics and fermion number anomaly inflow. Phys. Rev. D 92, 085024 (2015) *arXiv:1409.8339*

Swingle B, McGreevy J. Renormalization group constructions of topological quantum liquids and beyond. Phys. Rev. B 93, 045127 (2016) *arXiv:1407.8203*

Swingle B, Kim IH. Reconstructing quantum states from local data. Phys. Rev. Lett. 113, 260501 (2014) *arXiv:1407.2658*

Swingle B, Van Raamsdonk M. Universality of Gravity from Entanglement. *arXiv:1405.2933*

Swingle B. Entanglement entropy of compressible holographic matter: loop corrections from bulk fermions. Phys. Rev. B 90, 045107 (2014) *arXiv:1308.3234*

Swingle B. Entanglement does not generally decrease under renormalization. J. Stat. Mech. P10041 (2014) *arXiv:1307.8117*

Swingle B. A simple model of many-body localization. *arXiv:1307.0507*

Chowdhury D, Swingle B, Berg E, Sachdev S. Singularity of the London penetration depth at quantum critical points in superconductors. Phys. Rev. Lett. 111, 157004 (2013) *arXiv:1305.2918*

Behan C, Larjo K, Lashkari N, Swingle B, Van Raamsdonk M. Energy trapping from Hagedorn density of states. *arXiv:1304.7275* (accepted to JHEP)

Swingle B. Structure of entanglement in regulated Lorentz invariant field theories. *arXiv:1306.6402*

Swingle B, McMinis J, Tubman N. Oscillating terms in the Renyi entropy of Fermi liquids. Phys. Rev. B 87, 235112 (2013). *arXiv:1211.0006*

Sau J, Swingle B, Tewari S. A proposal to probe quantum non-locality of Majorana fermions using tunneling experiments. Phys. Rev. B 92, 020511 (2015) *arXiv:1210.5512*

Swingle B. Constructing holographic spacetimes using entanglement renormalization. *arXiv:1209.3304*

Swingle B. Interplay between short and long-range entanglement in symmetry protected phases. Phys. Rev. B 90, 035451 (2014) *arXiv:1209.0776*

Swingle B. Entanglement sum rules in exactly solvable models. Phys. Rev. Lett. 111, 100405 (2013). *arXiv:1209.0769*

Swingle B. Experimental signatures of 3d fractional topological insulators. Phys. Rev. B 86, 245111 (2012). *arXiv:1205.2085*

Huijse L, Swingle B. Area law violations in a supersymmetric model. Phys. Rev. B 87, 035108 (2013). *arXiv:1202.2367*

Swingle B, Senthil T. Universal crossovers between entanglement entropy and thermal entropy. Phys. Rev. B 87, 045123 (2013) *arXiv:1112.1069*

Huijse L, Sachdev S, Swingle B. Hidden Fermi surfaces in compressible states of gauge-gravity duality. Phys. Rev. B 85, 035121 (2012). *arXiv:1112.0573*

Swingle B, Senthil T. Entanglement structure of deconfined quantum critical points. Phys. Rev. B 86, 155131 (2012). *arXiv:1109.3185*

Tran K, McGreevy J, Swingle B. Fractional Chern Insulators from the n th root of band structure. Phys. Rev. B 85, 125105 (2012). *arXiv:1109.1569*

Swingle B, Senthil T. A geometric proof of the equality between entanglement and edge spectra. Phys. Rev. B 86, 045117 (2012). *arXiv:1109.1283*

McGreevy J, Swingle B. Non-abelian statistics versus the Witten anomaly. Phys. Rev. D 84, 065019 (2012). *arXiv: 1106.004v1*

Swingle B. Mutual information and the structure of entanglement in quantum field theory. *arXiv: 1010.4038v1* (submitted to Phys. Rev. D)

Swingle B. Renyi entropy, mutual information, and fluctuation properties of Fermi liquids. Phys. Rev. B 86, 045109 (2012). *arXiv: 1007.482*

Swingle B, Barkeshli M, McGreevy J, Senthil T. Correlated Topological Insulators and The Fractional Magnetoelectric Effect. Phys Rev B. 83, 195139 (2011). *arXiv:1005.1076*

Swingle B. Conformal field theory approach to Fermi liquids and other highly entangled states. Phys. Rev. B 86, 035116 (2012). *arXiv:1003.2434 and 1002.4635*

Swingle B, Wen XG. Topological Properties of Tensor Network States From Their Local Gauge and Local Symmetry Structures. *arXiv:1001.4517*

Swingle B. Entanglement Entropy at Finite Density From Extremal Black Holes. *arXiv:0908.1737*.

Swingle B. Entanglement Entropy and the Fermi Surface. *Phys. Rev. Lett.* 105, 050502 (2010).
arXiv:0908.1724

Swingle B. Entanglement Renormalization and Holography. *Phys. Rev. D* 86, 065007 (2012).
arXiv:0905.1317

Gu ZC, Levin M, Swingle B, and Wen XG. Tensor-product representations for string-net condensed states. *Phys. Rev. B.* 79, 085118 (2009). *arXiv:0809.2821*

Hammer HW, Swingle B. On the limit cycle for the $1/r^2$ potential in momentum space. *Annals of Physics* 321, 306 (2006). *arXiv:quant-ph/0503074*

Swingle B, Kennedy TAB. Generation of topological flows by phase imprinting. *Journal of Physics B* 38, 3503 (2005).