

Brian J. Skinner

CONTACT INFORMATION	Massachusetts Institute of Technology 77 Massachusetts Ave Bldg. 4-345c Cambridge, MA 02139 USA	<i>Phone:</i> +1-617-253-3896 <i>E-mail:</i> skinner1@mit.edu
EMPLOYMENT HISTORY	Massachusetts Institute of Technology , Cambridge, MA USA <i>Postdoctoral Associate</i> Supervisor: Leonid Levitov	August 2015 – present
	Argonne National Laboratory Materials Science Division, Argonne, IL USA <i>Eugene Wigner Postdoctoral Fellow</i> Supervisor: K. A. Matveev	August 2013 – August 2015
	University of Minnesota Physics Department, Minneapolis, MN USA <i>Research Associate</i> Advisors: B. I. Shklovskii and Alexander L. Efros	September 2011 – August 2013
EDUCATION	University of Minnesota , Minneapolis, MN USA Ph.D., <i>Physics</i> , August 2011 Dissertation: <i>Microscopic Theory of Supercapacitors</i> Advisor: Boris I. Shklovskii	
	Virginia Polytechnic Institute and State University , Blacksburg, VA USA B.S., <i>Physics</i> and B.S., <i>Mechanical Engineering</i> , May 2007 <i>Summa cum Laude</i> , Honors Baccalaureate diploma Minors in Mathematics and Spanish	
SELECTED AWARDS	Eugene Wigner Postdoctoral Fellowship , 2013 University of Minnesota Physics Department: <ul style="list-style-type: none">• Anatoly Larkin Fellowship, 2008• Outstanding TA Award, 2008 National Science Foundation Graduate Research Fellowship , 2007 (used 2008 – 2011) Rhodes Scholarship finalist, 2007 Phi Kappa Phi Yoerger Presidential Fellowship , 2007 Barry M. Goldwater Research Scholarship , 2006 Virginia Polytechnic Institute and State University: <ul style="list-style-type: none">• Physics Department Scholarships (5), 2003–2007• College of Science Scholarships (4), 2003–2006• College of Engineering Scholarships (7), 2002–2006 National Merit Scholarship , 2002 NCTE Achievement Awards in Writing , 2001	
SUMMARY OF RESEARCH INTERESTS	I am a theorist focusing mostly on many-electron systems with strong correlations and long-ranged interactions. I have a particular focus on topological materials and strong disorder.	

46. J. Crossno, K. C. Fong, B. Skinner, L. Levitov, and P. Kim, *Magneto-thermal transport in graphene via Johnson Noise*, in preparation (2017).
45. Tristan Shi, Brian Skinner, Brandt C. Pein, Yaqing Zhang, Pin-Chun Shen, Edbert J. Sie, Jake Siegel, Yi-Hsien Lee, Jing Kong, and Keith A. Nelson, *Terahertz Electro-optic Modulator with Monolayer MoS₂*, in preparation for submission to Nature Materials (2017).
44. D. Nandi, Gil-Ho Lee, K. Huang, Cui-Zu Chang, K. Shain, Yunbo Ou, J. Ward, Inti Sodemann, Brian Skinner, S.P. Lee, J.S. Moodera, P. Kim, and A. Yacoby, *Nonlocal resistance in pristine ultrathin topological insulators*, in preparation for submission to Physical Review B (2017).
43. D. K. Efetov, R.-J. Schiue, Y. Gao, B. Skinner, E. Walsh, C. Choi, J. Zheng, C. Tan, G. Grosso, C. Peng, J. Hone, K. C. Fong, and D. Englund, *A high-sensitivity, nanocavity-coupled bolometer based on Johnson noise detection of hot electrons in graphene*, arxiv:1711.02142, submitted to Nature Photonics (2017).
42. Debanjan Chowdhury, Brian Skinner, and Patrick A. Lee, *Effect of magnetization on the tunneling anomaly in compressible quantum Hall states*, arxiv:1709.06091 (2017).
41. Brian Skinner and Liang Fu, *Large, nonsaturating thermopower in a quantizing magnetic field*, arxiv:1706.06117 (2017).
40. S. V. Syzranov and Brian Skinner, *Electron transport in nodal-line semimetals*, Phys. Rev. B **96**, 161105(R) (2017).
39. Anand Bhattacharya*, Brian Skinner*, Guru Khalsa, and Alexei Souslov, *Spatially inhomogeneous electron state deep in the extreme quantum limit in strontium titanate*, Nature Communications **7**, 12974 (2016).
38. Tianran Chen and Brian Skinner, *Enhancement of hopping conductivity by spontaneous fractal ordering of low-energy sites*, Phys. Rev. B **94**, 085146 (2016). 
37. Brian Skinner, *Mathematical toy model inspired by the problem of the adaptive origins of the sexual orientation continuum*, Royal Society Open Science **3**, 160403 (2016).
36. Brian Skinner, *Interlayer excitons with tunable dispersion relation*, Phys. Rev. B **93**, 235110 (2016).
35. Brian Skinner, *Chemical potential and compressibility of quantum Hall bilayer excitons*, Phys. Rev. B **93**, 085436 (2016).
34. Yingying Wu, Xiaolong Chen, Zefei Wu, Shuigang Xu, Tianyi Han, Jiangxiazhi Lin, Brian Skinner, Yuan Cai, Yuheng He, Chun Cheng, and Ning Wang, *Negative compressibility in graphene-terminated black phosphorus heterostructures*, Phys. Rev. B **93**, 035455 (2016).
33. Brian Skinner and Stephen. J. Guy, *A method for using player tracking data in basketball to learn player skills and predict team performance*, PLoS ONE 10(9): e0136393 (2015).
32. J. J. Dong, B. Skinner, N. Breecher, B. Schmittmann, and R. K. P. Zia, *Spatial structures in a simple model of population dynamics for parasite-host interactions*, Europhys. Lett. **111**, 48001 (2015).
31. Han Fu, B. I. Shklovskii, and Brian Skinner, *Correlation effects in the capacitance of a gated carbon nanotube*, Phys. Rev. B **91**, 155118 (2015).
30. Ioannis Karamouzas, Brian Skinner, and Stephen J. Guy, *Universal Power Law Governing Pedestrian Interactions*, Phys. Rev. Lett. **113**, 238701 (2014). 
29. Brian Skinner, *The price of anarchy is maximized at the percolation threshold*, Phys. Rev. E **91**, 052126 (2015).

28. Brian Skinner, *Coulomb disorder in three-dimensional Dirac systems*, Phys. Rev. B **90**, 060202(R) (2014).
26. Ting Chen, Wei Xie, B. I. Shklovskii, Brian Skinner, and U. Kortshagen, *Carrier Transport in Films of Alkyl-Ligand-Terminated Silicon Nanocrystals*, J. Phys. Chem. C **118**, 19580 (2014).
26. Brian Skinner, B. I. Shklovskii, and M. B. Voloshin, *Bound state energy of a Coulomb impurity in gapped bilayer graphene: "Hydrogen atom with a Mexican hat"*, Phys. Rev. B **89**, 041405(R) (2014).
25. Brian Skinner, G. L. Yu, A. V. Kretinin, A. K. Geim, K. S. Novoselov, and B. I. Shklovskii, *Effect of dielectric response on the quantum capacitance of graphene in a strong magnetic field*, Phys. Rev. B **88**, 155417 (2013).
24. Brian Skinner, Tianran Chen, and B. I. Shklovskii, *Effect of bulk charged impurities on the bulk and surface transport in three-dimensional topological insulators*, JETP **144**, 662 (2013).
23. Brian Skinner and B. I. Shklovskii, *Theory of the random potential and conductivity at the surface of a topological insulator*, Phys. Rev. B **87**, 075454 (2013).
22. Yeonbae Lee, Tianran Chen, Brian Skinner, Aviad Frydman, and A. M. Goldman, *Electrostatic tuning of the properties of disordered indium-oxide films near the superconductor-insulator transition*, Phys. Rev. B **88**, 024509 (2013).
21. Mehrtash Babadi, Brian Skinner, Michael M. Fogler, and Eugene Demler, *Universal behavior of repulsive two-dimensional fermions in the vicinity of the quantum freezing point*, Europhys. Lett. **103**, 16002 (2013).
20. Brian Skinner and Bradley P. Carlin, *The price of anarchy – on the roads and in football*, Significance **10**, 3, 25–30 (2013).
19. Brian Skinner and B. I. Shklovskii, *Giant capacitance of a plane capacitor with a two-dimensional electron gas in a magnetic field*, Phys. Rev. B **87**, 035409 (2013).
18. Brian Skinner, Tianran Chen, and B. I. Shklovskii, *Why is the bulk resistivity of topological insulators so small?*, Phys. Rev. Lett. **109**, 176801 (2012).
17. Tianran Chen, Brian Skinner, and B. I. Shklovskii, *Coulomb gap triptych in a periodic array of metal nanocrystals*, Phys. Rev. Lett. **109**, 126805 (2012).
16. Tianran Chen, Brian Skinner, and B. I. Shklovskii, *Coulomb gap triptychs, $\sqrt{2}$ effective charge, and hopping transport in periodic arrays of superconductor grains*, Physical Review B **86**, 045135 (2012). 
15. Brian Skinner, Tianran Chen, and B. I. Shklovskii, *Theory of hopping conduction in arrays of doped semiconductor nanocrystals*, Physical Review B **85**, 205316 (2012).
14. Brian Skinner *The problem of shot selection in basketball*, PLoS ONE **7**(1): e30776 (2012).
13. Tianran Chen, Brian Skinner, and B. I. Shklovskii, *Cooperative charging in a nanocrystal assembly gated by ionic liquid*, Physical Review B **84**, 245304 (2011).
12. Brian Skinner, M. M. Fogler, and B. I. Shklovskii, *Model of large volumetric capacitance in graphene supercapacitors based on ion clustering*, Physical Review B **84**, 235133 (2011).
11. Brian Skinner, *Scoring Strategies for the Underdog: A General, Quantitative Method for Determining Optimal Sports Strategies*, Journal of Quantitative Analysis in Sports: Vol. 7: Iss. 4, Article 11 (2011).

10. A. L. Efros, Brian Skinner, and B. I. Shklovskii, *Coulomb gap in the one-particle density of states in three-dimensional systems with localized electrons*, Physical Review B **84**, 064204 (2011).
9. Brian Skinner, Tianran Chen, M. S. Loth, and B. I. Shklovskii, *Theory of volumetric capacitance of an electric double layer supercapacitor*, Physical Review E **83** 056102 (2011).
8. Brian Skinner and M. M. Fogler, *Simple variational method for calculating energy and quantum capacitance of an electron gas with screened interactions*, Physical Review B **82**, 201306(R) (2010).
7. M. S. Loth, Brian Skinner, and B. I. Shklovskii, *Anomalously large capacitance of an ionic liquid described by the restricted primitive model*, Physical Review E **82**, 056102 (2010).
6. Brian Skinner and B. I. Shklovskii, *Anomalously large capacitance of a plane capacitor with a two-dimensional electron gas*, Physical Review B **82**, 155111 (2010). 
5. M. S. Loth, Brian Skinner, and B. I. Shklovskii, *Non-mean-field theory of anomalously large double-layer capacitance*, Physical Review E **82**, 016107 (2010).
4. Brian Skinner, M. S. Loth, and B. I. Shklovskii, *Capacitance of the Double Layer Formed at the Metal/Ionic-Conductor Interface: How Large Can It Be?*, Physical Review Letters **104**, 128302 (2010).
3. Brian Skinner, *The price of anarchy in basketball*, Journal of Quantitative Analysis in Sports: Vol. 6 : Iss. 1, Article 3 (2010).
2. Brian Skinner, M. S. Loth, and B. I. Shklovskii, *Ionic conductivity on a wetting surface*, Physical Review E **80**, 041925 (2009).
1. Brian Skinner and B. I. Shklovskii, *Non-monotonic swelling of a macroion due to correlation-induced charge inversion*, Physica A **388**, 1 (2009).

BOOK
CHAPTERS

Brian Skinner and Matthew Goldman, "Optimal Strategy in Basketball". In *Handbook of Statistical Methods and Analyses in Sports*, part of the series of Handbooks of Modern Statistical Methods, CRC Press, 2017.

SELECTED
INVITED
PRESENTATIONS

Semimetals Unlimited, Caltech Condensed Matter Physics seminar, November 2017.

Three surprising short stories about electron puddles, Kavli Institute for Theoretical Physics seminar, April 2017.

Is there a theory of optimal strategy in basketball?, Harvard Sports Analytics Cooperative meeting, February 2017.

Field-tunable Bosonic Phases of Interlayer Excitons, Boston Area CarBon Nanoscience Meetings (BACON+), Harvard, February 2016.

Nonlinear screening of charged impurities in topological materials, MIT Condensed Matter Theory Seminar, September 2015.

A toy model of reaction-diffusion processes with topological degrees of freedom, Caltech IQIM seminar, July 2015

Disorder-assisted transport in topological insulators and nanocrystal superlattices, MIT, Center for Excitonics Seminar, May 2015.

Problems in Human Motion Planning,

New York University, [Applied Math Lab Seminar](#), April 2016;
Harvard University, [Widely Applied Mathematics Seminar](#), February 2016;
Notre Dame University, [Condensed Matter/Biophysics Seminar](#), April 2015;
University of Virginia, [Condensed Matter Seminar](#), February 2015;
Simons Foundation, January 2015;
University of Minnesota, [Condensed Matter Seminar](#), October 2014;
University of Chicago, [Computations in Science Seminar](#), July 2014.

Negative compressibility and supercapacitors,

University of Illinois, Chicago, [Condensed Matter/Biophysics Seminar](#), April 2015;
Emory University, Physics Department Colloquium, January 2015;
University of California, San Diego, [Condensed Matter Seminar](#), January 2015;
Washington University in St. Louis, [Condensed Matter seminar](#), September 2014;
University of Texas at Austin, [Condensed Matter Seminar](#), April 2014;
Massachusetts Institute of Technology, [Chez Pierre seminar](#), October 2013;
Harvard University, special condensed matter seminar, October 2013.

The physics of supercapacitors,

UCLA, [Physics and Astronomy Colloquium](#), May 2014;
University of Washington, [Physics Department Colloquium](#), February 2014;
University of Minnesota, Electrical and Computer Engineering Department Colloquium Series, April 2012.

Hopping transport and the "Coulomb gap triptych" in nanocrystal arrays, [Conference: Transport in Interacting Disordered Systems](#), Barcelona, September 2013.

Theory of hopping transport in arrays of doped semiconductor nanocrystals, [Workshop: Electron Transport in Nanocrystal Assemblies](#), University of Minnesota, June 2013.

Large capacitance enhancement in graphene driven by electron correlations, [Workshop: Electron Interactions in Graphene and Other New 2D Materials](#), University of Minnesota, May 2013.

Hopping transport in quantum dot arrays, Physics Department Colloquium Series, University at Buffalo, State University of New York, March 2013.

The Price of Anarchy in Basketball, [MIT Sloan Sports Analytics Conference](#) (research paper contest winners), Boston, MA, March 2010.

Implementing a Quantum Random Walk on a Four-Qubit Quantum Information Processor, Virginia Tech, [Condensed Matter Seminar](#), September 2005.

REFEREE
SERVICE

Physical Review Letters, Physical Review B, Physical Review E, Physical Review Applied, Nature Communications, Scientific Reports, npj 2D Materials and Applications, IEEE Transactions on Electronic Devices, PLOS Computational Biology, Journal of Quantitative Analysis in Sports

Reviewer for DOE grant proposals

PREVIOUS
RESEARCH
EXPERIENCE

Virginia Tech Physics Department, Blacksburg, VA USA

Undergraduate research assistant January 2003 – May 2007

- Theoretical condensed matter: non-equilibrium driven systems
- Advisors: B. Schmittmann and R. K. P. Zia.

Undergraduate research assistant May 2004 – December 2006

- Neutrino physics: UCN-A (Los Alamos) and Borexino (Gran Sasso) experiments
- Advisor: R. Bruce Vogelaar

CERN, Geneva, Switzerland

Summer student/REU undergraduate research assistant June – August 2006

- Calibration of the CMS hadronic calorimeter
- Advisor: Nural Akchurin, [Texas Tech University](#)

MIT Department of Nuclear Engineering, Cambridge, MA

REU undergraduate research assistant June – August 2005

- NMR quantum computing
- Advisor: David G. Cory

United States Naval Research Laboratory, Washington, DC

Physical science aid June – August 2001, 2002

- Acoustic scattering
- Advisor: Charles F. Gaumont

TEACHING
EXPERIENCE
AND OUTREACH

Author of a popular physics blog, [Gravity and Levity](#), that explains upper-level concepts in physics and has been viewed over 900,000 times. March 2009 – present

Speaker at the USA Science and Engineering Festival in Washington DC. Talk entitled “Nanoscience and the ‘Choose Your Own Adventure’ Era of Quantum Physics”. April 2016

Teacher at MIT’s annual “[MIT Splash](#)” event for high school students. Courses designed and taught: November 2015, 2016, 2017

- “Quantum Mechanics with 9th Grade Math”
- “Quantum Field Theory Story Time”
- “The Math of Basketball Strategy”

Judge at high school and middle school science fairs in the Chicago area. January - March 2014

Judge at the Minnesota State Science Fair, high school and middle school level, sponsored by the Minnesota Academy of Science. April 2013

University of Minnesota, Minneapolis, MN USA

Teaching Assistant September 2007 – May 2008

- PHYS 1301: Introductory Physics for Science and Engineering I (2 sections)
- PHYS 1202: Introductory Physics for Biology and Pre-medicine II (2 sections)

Private tutoring September 2007 – December 2008

- PHYS 1202: Introductory Physics for Biology and Pre-medicine II
- PHYS 1301: Introductory Physics for Science and Engineering I
- PHYS 1302: Introductory Physics for Science and Engineering II
- PHYS 2201: Introductory Thermodynamics and Statistical Physics

SELECTED
POPULAR PRESS
COVERAGE

Phys.org, "Electrons 'puddle' under high magnetic fields, study reveals", January 2017.
The Guardian, "Fundamental physics comes in various flavors", October 2016.
Inside Science, "Electrons in Semiconductors Don't Follow Random Routes", August 2016.
Physics World, "Web life: Gravity and Levity", June 2016.
Boston Globe, "In crowds, human 'particles' follow laws of movement", December 2014.
APS Physics Focus, "Focus: Anticipation is the Key to Crowd Physics", December 2014.
Nature News and *Scientific American*, "Mathematical Time Law Governs Crowd Flow", November 2014.
Wired Magazine, "NBA Players Scoff at Mathematical Model Suggesting When to Shoot", February 2012.
Science Magazine, "The Mathematics of Basketball", August 2011.
ESPN.com, "Getting the ball in the hoop is like commuting to work", April 2010.
MIT Technology Review, "Basketball and the theory of networks", August 2009.

REFERENCES

Prof. Boris Shklovskii
University of Minnesota
shklovsk@physics.umn.edu
612-625-0771

Prof. Patrick Lee
Massachusetts Institute of Technology
palee@mit.edu
617-253-8325

Prof. Liang Fu
Massachusetts Institute of Technology
liangfu@mit.edu
617-253-7132

Prof. Jim Eisenstein
Caltech
jpe@caltech.edu
626-395-4649

Prof. Leonid Levitov
Massachusetts Institute of Technology
levitov@mit.edu
617-253-6817