

# JUSTIN H. WILSON

## PERSONAL INFORMATION

*Born in Texas, 14 January 1985*

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## RESEARCH INTERESTS

Cold atoms; strongly correlated electron systems; mathematical physics; entanglement in condensed matter systems; the Casimir effect as a probe of condensed matter phenomena; topological states of matter; many-body localization.

## EDUCATION

*Doctor of Philosophy* 2007-2015 The University of Maryland, College Park  
GPA: 4.0 · *Theoretical Condensed Matter Physics* · Department: Physics  
Dissertation: *Optical and Casimir Effects in Topological Materials*  
Description: In this dissertation, I explored the Casimir effect of Weyl semimetals as well as in other thin-film materials along with the magneto-optics of a thin film topological insulator, the break down of the coherent state path integral.  
Advisor: Prof. Victor M. GALITSKI

*Master of Science* 2007-2011 The University of Maryland, College Park  
GPA: 4.0 · *Theoretical Condensed Matter Physics* · Department: Physics  
Description: This degree focussed on graduate level coursework in physics.

*Bachelor of Science* 2003-2007 Texas A&M University, College Station  
*Bachelor of Science* GPA: 4.0 · Major: Physics  
GPA: 4.0 · Major: Mathematics  
Thesis: *Vacuum energy in quantum graphs*  
Advisors: Prof. Stephen FULLING and Prof. Gregory BERKOLAIKO  
Honors: *Summa Cum Laude*, Foundation Honors, University Honors, Honors in Math, and University Undergraduate Research Fellow.  
Description: Double degrees in both physics and mathematics.

## EMPLOYMENT

*Caltech* 2015-Present Postdoctoral Researcher, CALIFORNIA INSTITUTE OF TECHNOLOGY — Pasadena, CA  
Working on projects related to cold atoms, topology, and entanglement.  
Reference: Gil REFAEL · +1 (626) 395 4705 · [refael@caltech.edu](mailto:refael@caltech.edu)

*University of Maryland* 2007-2015 Teaching/Research Assistant, UNIVERSITY OF MARYLAND — College Park, MD  
Teaching physics labs, coursework, and grading. Additionally, research that would impart become part of my Ph.D. thesis.  
Reference: Victor GALITSKI +1 (301) 405 6107 · [galitski@umd.edu](mailto:galitski@umd.edu)

Summer work between junior and senior years doing research that would become part of my undergraduate honors thesis.

Reference: Stephen FULLING +1 (979) 220 9606 · [fulling@math.tamu.edu](mailto:fulling@math.tamu.edu)

## PUBLICATIONS

### Papers in Refereed Journals

1. A. A. Allocca, J. H. Wilson, and V. M. Galitski, Quantum interference phenomena in the Casimir effect, *Phys. Rev. A* **91**, 062512 (2015). [arXiv:1501.06096](https://arxiv.org/abs/1501.06096)
2. J. H. Wilson, A. A. Allocca, and V. M. Galitski, Repulsive Casimir force between Weyl semimetals, *Phys. Rev. B* **91**, 235115 (2015). [arXiv:1501.07659](https://arxiv.org/abs/1501.07659)
3. J. H. Wilson, D. K. Efimkin, and V. M. Galitski, Resonant Faraday and Kerr effects due to in-gap states on the surface of topological insulator, *Phys. Rev. B* **90**, 205432 (2014). [arXiv:1408.5139](https://arxiv.org/abs/1408.5139)
4. A. A. Allocca, J. H. Wilson, and V. Galitski, Non-analytic behavior of the Casimir force across a Lifshitz transition in a spin-orbit coupled material, *Phys. Rev. B* **90**, 075420 (2014). [arXiv:1312.6754](https://arxiv.org/abs/1312.6754)
5. J. H. Wilson, J. Mitchell, and V. Galitski, Probing the structure of entanglement with entanglement moments, *Solid State Comm.* **195**, 43-48 (2014). [arXiv:1305.2005](https://arxiv.org/abs/1305.2005)
6. J. H. Wilson, B. M. Fregoso, and V. M. Galitski, Entanglement dynamics in a non-Markovian environment: An exactly solvable model, *Phys. Rev. B* **85**, 174304 (2012). [arXiv:1202.1614](https://arxiv.org/abs/1202.1614)
7. J. H. Wilson and V. Galitski, Breakdown of the coherent states path integral: two simple examples, *Phys. Rev. Lett.* **106**, 110401 (2011). [arXiv:1012.1328](https://arxiv.org/abs/1012.1328)
8. G. Berkolaiko, J. Harrison, and J. H. Wilson, Mathematical aspects of vacuum energy in quantum graphs, *J. Phys. A: Math. Theor.* **42**, 025204 (2009). [arXiv:0711.2707](https://arxiv.org/abs/0711.2707)
9. S. A. Fulling, P. Kuchment, and J. H. Wilson, Index theorems for quantum graphs, *J. Phys. A: Math. Theor.* **40**, 14165–14180 (2007). [arXiv:0708.3456](https://arxiv.org/abs/0708.3456)
10. S. A. Fulling, L. Kaplan, and J. H. Wilson, Vacuum energy and repulsive Casimir forces in quantum star graphs, *Phys. Rev. A* **76**, 012118 (2007). [arXiv:quant-ph/0703248](https://arxiv.org/abs/quant-ph/0703248)

### Contributed Papers

1. S. A. Fulling and J. H. Wilson, Vacuum energy and closed orbits in quantum graphs, *Proc. Symp. Pure Math.* **77**, 673–689 (2008) (volume associated with the program Analysis on Graphs and its applications, Newton Institute, 2007).

### Theses

Optical and Casimir Effects in Topological Materials, Ph. D. Dissertation in condensed matter physics, University of Maryland at College Park, 2015.  
<http://hdl.handle.net/1903/16633>

Vacuum Energy in Quantum Graphs, University Undergraduate Research Fellows Thesis, Texas A&M University, 2007.  
<http://handle.tamu.edu/1969.1/5682>

## TALKS

### Invited Talks

1. “Entanglement and the Hilbert-Schmidt distance”, Department Seminar: Department of Physics, Boston University, Boston (7 December 2012).
2. “Lie Algebraic approaches to quantum dynamics: The breakdown of the coherent state path integral and the Bose-Hubbard model.” Conference: *Lie Theory and Its Applications in Physics*, Varna, Bulgaria (June 2011)
3. “Generalized Method of Images on Quantum Graphs”, Departmental Seminar: Department of Mathematics, Texas A&M University, Texas (2 November 2007).

4. "The Method of Images on a Quantum Graph", Conference: *Quantum Graphs, their Spectra and Applications*, Newton Institute, Cambridge, U.K., (15 March 2007).

#### Contributed Talks

1. "Repulsive Casimir effect between Weyl semimetals", *APS March Meeting*, San Antonio, TX (March 2015).
2. "Optics of midgap impurity states on a surface of a topological insulator", *APS March Meeting*, Denver, CO (March 2014).
3. "Quantum geometry and entanglement in the Rabi model", *APS March Meeting*, Baltimore, MD (March 2013).
4. "A Lie-algebraic approach to decoherence in a quantum spin system", *APS March Meeting*, Boston, MA (28 February 2012).
5. "Breakdown of the coherent state path integral: two simple examples", *APS March Meeting*, Dallas, TX (March 2011).
6. "Path integral representation of a two qubit system", *APS March Meeting*, Portland, OR (March 2010).
7. "Vacuum Energy in Quantum Graphs", Conference: *Quantum Field Theory Under the Influence of External Conditions*, Universität Leipzig, Germany, (September 2007).

#### Contributed Posters

1. "Entanglement dynamics in a non-Markovian environment: An exactly solvable model", *Nonlinear Physics at the Nanoscale: A Cross-Fertilization on Stochastic Methods*, Rotorua, NZ (February 2015).
2. "Resonant Faraday and Kerr effects due to in-gap states on the surface of topological insulator", *GRC/GRS: Correlated electron systems*, Mount Holyoke College, South Hadley, MA (June 2014).

#### OTHER MEETINGS ATTENDED

##### Conferences

1. *International Conference on Atomic Physics (ICAP) 2014*, Washington, DC (August 2014).
2. *Analysis on Graphs and its Applications Follow-up*, Newton Institute, Cambridge, U.K., (July 2010).
3. *Quantum Field Theory Under the Influence of External Conditions*, University of Oklahoma, Norman, OK (September 2009).

## Summer Schools

1. *Princeton Summer School in Condensed Matter Physics: Quantum Information*, Princeton University, Princeton, NJ (July 2014).
2. *Boulder School 2013: Disorder and dynamics in quantum systems*, Boulder, CO (July-August, 2013)
3. *Princeton Summer School in Condensed Matter Physics: Critical Phenomena and Quantum Computation*, Princeton University, Princeton, NJ (July 2012).
4. *LMS instructional course: Analysis on Graphs and its Applications*, Gregynog Hall, Wales (January 2007).

## OTHER INFORMATION

### Service

- 2011-present · Referee for IOP journals J. Phys. A, J. Phys. B, and J. Phys.: Cond. Mat.
- 2006–2007 · Vice President, Texas A&M chapter of Pi Mu Epsilon.

### Popular Talks

1. “**Real Fake-Particles: From Crystals to Quantum Computation to the Nature of the Universe**”, *Skepticamp DC*, College Park, MD (September 2012).
2. “Quantum Physics and its Interpretations”, *Skepticamp DC*, College Park, MD (October 2011).

### Awards

- 2008 · Iskraut award for classical physics (Highest score on classical physics qualifier), **\$1,000**.
- 2007 · Texas A&M University’s nominated thesis (see above thesis) for the National Collegiate Honors Council’s (NCHC) Portz Award.
- 2005–2007 · Astronaut Scholar, **\$20,000**.
- 2006 · John B. Beckham Award; given to two graduating seniors in the College of Science at Texas A&M, **\$1,000**.
- 2006 · James G. Potter Scholarship, **\$500**.
- 2005, 2006 · Honors Incentive Award, **\$2,000**.
- 2005 · First Place in Texas A&M Freshman-Sophomore Math Contest.

### Honor Societies

- 2006 · Phi Beta Kappa.
- 2007 · Phi kappa Phi.
- 2007 · Sigma Xi.
- 2006 · Pi Mu Epsilon.

June 29, 2015