

Edwin Miles Stoudenmire

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Research Experience

2013-Pres. Postdoctoral Researcher, Perimeter Institute for Theoretical Physics

2010-2013 Postdoctoral Researcher, UC Irvine
Supervisors: Steven R. White and Kieron Burke

- Performed state of the art simulations of model continuum electronic systems, frustrated magnets, and topologically ordered nanowires.
- Discovered a method for parallelizing the density matrix renormalization group (DMRG) algorithm in real space.
- Extensively developed an open-source C++ library for tensor product wavefunction algorithms and DMRG. Website: <http://itensor.org/>

2005-2010 Graduate Research Assistant, UC Santa Barbara
Supervisor: Leon Balents

- Applied a variety of analytical methods (bosonization, mean-field theory, spin wave calculations, high temperature series) to study frustrated magnets.
- Developed code based on the [ALPS](#) simulation library to implement a novel semi-classical algorithm for finite temperature quantum magnets.
- Collaborated with Steven R. White on a new method for simulating finite temperature quantum systems ([METTS](#) algorithm).

Education

2010 PhD in Physics, UC Santa Barbara. Advisor: Leon Balents

2005 BS in Physics, Georgia Institute of Technology, highest honors

2005 BS in Mathematics, Georgia Institute of Technology, highest honors

Publications

2015 Sharmistha Sahoo **E.M. Stoudenmire**, Jean-Marie Stéphan, Trithep Devakul, Rajiv R. P. Singh, and Roger Melko, “Unusual Corrections to Scaling and Convergence of Universal Renyi Properties at Quantum Critical Points”, arxiv:[1509.00468](#)

2015 Thomas E. Baker, **E.M. Stoudenmire**, Lucas O. Wagner, Kieron Burke, and Steven R. White, “One Dimensional Mimicking of Electronic Structure: The Case for Exponentials”, arxiv:[1504.05620](#)

- 2015 **E.M. Stoudenmire**, David J. Clarke, Roger S. K. Mong, and Jason Alicea, “Assembling Fibonacci Anyons from a \mathbb{Z}_3 Parafermion Lattice Model”, *Phys. Rev. B* **91**: [235112](#) [Editor’s suggestion]
- 2015 Z. Papic, **E.M. Stoudenmire**, and Dmitry A. Abanin, “Is Many-Body Localization Possible in the Absence of Disorder?”, arxiv:[1501.00477](#)
- 2014 **E.M. Stoudenmire**, Peter Gustainis, Ravi Johal, Stefan Wessel, and Roger G. Melko, “Corner Contribution to the Entanglement Entropy of Strongly-Interacting O(2) Quantum Critical Systems in 2+1 Dimensions”, *Phys. Rev. B* **90**: [235106](#)
- 2014 Lucas O. Wagner, Thomas E. Baker, **E.M. Stoudenmire**, Kieron Burke, and Steven R. White , “Kohn-Sham Calculations with the Exact Functional”, *Phys. Rev. B* **90**: [045109](#) [Editor’s suggestion]
- 2014 A.B. Kallin, **E.M. Stoudenmire**, P. Fendley, R.R.P. Singh and R.G. Melko , “Corner Contribution to the Entanglement Entropy of an O(3) Quantum Critical Point in 2+1 Dimensions”, *J. Stat. Mech.* (2014) [P06009](#)
- 2013 Lucas O. Wagner, **E.M. Stoudenmire**, Kieron Burke, and Steven R. White , “Guaranteed Convergence of the Kohn-Sham Equations”, *Phys. Rev. Lett.* **111**: [093003](#) [Editor’s suggestion]
- 2013 **E.M. Stoudenmire** and Steven R. White, “Real-space parallel density matrix renormalization group”, *Phys. Rev. B* **87**: [155137](#)
- 2013 Salvatore R. Manmana, **E.M. Stoudenmire**, Kaden R.A. Hazzard, Ana Maria Rey and Alexey V. Gorshkov, “Topological phases in ultracold polar-molecule quantum magnets”, *Phys. Rev. B* **87**: [081106\(R\)](#)
- 2012 **E.M. Stoudenmire**, Lucas O. Wagner, Steven R. White and Kieron Burke, “One-dimensional continuum electronic structure with the density matrix renormalization group and its implications for density functional theory”, *Phys. Rev. Lett.* **109**: [056402](#)
- 2012 Lucas O. Wagner, **E.M. Stoudenmire**, Kieron Burke and Steven R. White, “Reference electronic structure calculations in one dimension”, *Phys. Chem. Chem. Phys.* **14**: [8581](#)
- 2012 **E.M. Stoudenmire** and Steven R. White, “Studying two dimensional systems with the density matrix renormalization group”, *Annual Reviews of Condensed Matter Physics* **3**: [111](#)
- 2011 **E.M. Stoudenmire**, Jason Alicea, Oleg A. Starykh and Matthew P.A. Fisher, “Interaction effects in topological superconducting wires supporting majorana fermions”, *Phys. Rev. B* **84**: [014503](#) [Editor’s suggestion, [Synopsis Article](#)]
- 2010 **E.M. Stoudenmire** and Steven R. White, “Minimally entangled typical thermal state algorithms” *New J. Phys.* **12**: [055026](#)
- 2009 **E.M. Stoudenmire**, Simon Trebst and Leon Balents, “Quadrupolar correlations and spin freezing in S=1 triangular lattice antiferromagnets”, *Phys. Rev. B* **79**: [214436](#)
- 2008 **E.M. Stoudenmire** and Leon Balents, “Ordered phases of the anisotropic kagome lattice antiferromagnet in a field”, *Phys. Rev. B* **77**: [174414](#)

2005 **E.M. Stoudenmire** and C.A.R. Sá de Melo, “Magnetoresistive effects in ferromagnet-superconductor multilayers”, *J. Appl. Phys.* **97**: [10J108](#)

Invited Research Talks

Apr 2015 MIT Condensed Matter Seminar, “*Uncovering the Fibonacci Phase in Z₃ Parafermion Systems*”. Cambridge, Massachusetts.

Apr 2015 Univ. of Illinois Condensed Matter Seminar, “*Uncovering the Fibonacci Phase in Z₃ Parafermion Systems*”. Urbana-Champaign, Illinois.

Feb 2015 Conference on Advanced Numerical Algorithms for Strongly Correlated Quantum Systems, “*Uncovering the Fibonacci Phase in Z₃ Parafermion Systems*”. Würzburg, Germany.

May 2014 UC Irvine, “*Numerical Evidence for Fibonacci Anyons in Lattice Models of Quantum Hall / Superconductor Heterostructures*”. Irvine, CA.

Sep 2012 LMU München, “*Parallelizing DMRG in Real Space*”. Munich, Germany.

Sep 2012 ITP Univ. of Cologne, “*New Tools for Simulating Realistic Systems with DMRG*”. Cologne, Germany.

Aug 2012 JILA and CU Dept. of Physics, “*Simulating Realistic Systems with DMRG*”. Boulder, CO.

May 2012 UC Merced Dept. of Chemistry, “*Exact Electronic Structure in 1d*”. Merced, CA.

Mar 2012 APS March Meeting, Symposium on DFT, “*Exact Density Functional Calculations with DMRG*”. Boston, MA.

Jun 2011 Microsoft Station Q Seminar, “*Interaction Effects in Topological Superconducting Wires*”. Santa Barbara, CA.

Oct 2010 L.A. Cond. Mat. Theory Meeting, “*DMRG Meets DFT*”. Pasadena, CA.

Invited Pedagogical Talks

Jun 2014 Simons Summer School on the Many-Electron Problem, “*Matrix Product States and DMRG*” and “*ITensor Hands-on*” (3 lectures and hands-on tutorials). Stony Brook, New York.

Jun 2014 International School on Computational Methods for Quantum Materials, “*Hands-on with the ITensor Library*” (2 lectures and hands-on tutorials). Sherbrooke, Québec.

Dec 2012 National Taiwan University, Winter School: DMRG 101. “*Studying Density Functional Theory and One-Dimensional Electronic Structure with DMRG*”. Taipei, Taiwan. [Video and Slides](#)

Dec 2012 Northeastern University, “*Introduction to MPS with the ITensor Library*” (2 lectures and hands-on tutorials). Boston, MA.

Mar 2012 IMSC Chennai, K.S. Krishnan Meeting on Tensor Network States “*From DMRG to Tensor Network States*” (2 Lectures, Delivered Online). Chennai, India.

Other Teaching Experience

- Mar 2015 Master's Course, Perimeter Institute PSI Program: "*Condensed Matter Explorations*" (14 lectures; I created and taught all the lectures)
- 2012-13 Substitute Lecturer. UCI advanced undergraduate quantum mechanics and condensed matter physics (6 Lectures).
- 2008 Substitute Lecturer. UCSB graduate condensed matter physics (4 Lectures).
- 2005-2009 Teaching Assistant. UCSB graduate courses in quantum many-body methods, condensed matter physics and advanced statistical mechanics.
- 2004-2005 Kaplan SAT Instructor. Atlanta, GA. Taught large classes of high school students from a wide range of socioeconomic backgrounds.
- 2002-2005 Teaching Assistant, Georgia Tech undergraduate mathematics courses
Taught weekly recitation sections for three years.

Selected Activities and Contributed Talks

- Aug 2014 Conference on Computational Physics, CCP2014, Boston University.
Talk title: "*Corner Contributions to Entanglement Entropy in Critical Systems*"
- May 2013 Emergence & Entanglement II Conference, Perimeter Institute for Theoretical Physics
- Sep 2012 Autumn School on Correlated Electrons: From Models to Materials.
Forschungszentrum Jülich, Germany.
- Jul 2010 Boulder Summer School in Condensed Matter Physics, *Computational Methods*.
Boulder, CO.
- Dec 2009 ICTS Winter School on Condensed Matter Physics. Mahabaleshwar, India.
- Mar 2009 IACS Conference on Recent Trends in Strongly Correlated Systems. Kolkata, India.
- Jan 2009 IPAM Workshop on Numerical Approaches to Quantum Many-Body Systems. UCLA.
- Jul 2008 Boulder Summer School in Condensed Matter Physics, *Strongly Correlated Materials*. Boulder, CO.
- Aug 2007 Abdus Salam ICTP School and Workshop on Highly Frustrated Magnets. Trieste, Italy.
- 2007-2010 Seminar organizer, UCSB Condensed Matter Theory Group

References available upon request