Edwin Miles Stoudenmire

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Research Experience

2016-Pres.   Research Scientist, Univ. of California Irvine

- Proposed machine learning framework based on powerful
  tensor network methods developed in physics. Link to video.

- Co-organized Quantum Machine Learning conference
  at the Perimeter Institute for Theoretical Physics.

2013-2016   Postdoctoral Researcher, Perimeter Institute for Theoretical Physics

- Performed highly cited research on non-abelian topological order in 2d lattice
  models and universal entanglement properties of critical systems

- Significantly expanded user base of ITensor software
  and developed ambitious new version 2.0 design.

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

- Discovered a method for parallelizing the density matrix
  renormalization group (DMRG) algorithm in real space.

- Extensively developed ITensor: an open-source C++ library for tensor
  network algorithms and DMRG. Website: http://itensor.org/

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

- Applied a variety of methods (bosonization, mean-field, spin wave
  high temperature series, Monte Carlo) to study frustrated 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

2016   **E.M. Stoudenmire** and D.J. Schwab, "Supervised Learning with Quantum-Inspired Tensor
Networks", arxiv:1605.05775 *Accepted to NIPS 2016 conference*

2016   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", *Phys. Rev. B* **93**: 085120

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", *Phys. Rev. B* **91**: 235141

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, "Many-body localization in disorder-free systems: The importance of finite-size constraints", Annals of Physics **362**, 714

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 2016	Simons Summer School on the Many-Electron Problem and Coding School, *"Design"*, *"Optimization"*, *"Intro to Julia"* and *"ITensor Hands-on"*. Stony Brook, New York.
Jun 2016 & 2014	International School on Computational Methods for Quantum Materials, *"Hands-on with the ITensor Library"* (2 lectures and hands-on tutorials). Sherbrooke, Québec.
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.

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 to groups of 20+ students.

Selected Activities and Contributed Talks

Aug 2016   **Co-Organizer**. Quantum Machine Learning, Perimeter Institute.
             Talk: *"Learning with Quantum-Inspired Tensor Networks"*. Talk video and slides.

Jan 2016   Physics Informed Machine Learning, Santa Fe. Poster: *"Supervised Learning with Quantum-Inspired Tensor Networks"*.

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.
             Forschungzentrum 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.

References available upon request