Edwin Miles Stoudenmire

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Employment

2017-Pres. Research Scientist, Flatiron Institute
Center for Computational Quantum Physics (CCQ)

2016-2017 Research Scientist, Univ. of California Irvine
Supported by the Simons Foundation Many-Electron Collaboration

2013-2016 Postdoctoral Researcher, Perimeter Institute for Theoretical Physics

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

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

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

Software

The ITensor software for tensor network calculations, used in over 1000 publications.
Website: https://itensor.org.

Publications

2026 Zhaonan Meng, Yuehaw Khoo, Jiajia Li, **E.M. Stoudenmire**, "Recursive Sketched Interpolation: Efficient Hadamard Products of Tensor Trains", arxiv:2602.17974

2025 B. Xiao, B. Kloss, **E.M. Stoudenmire**, "Investigating a Quantum-Inspired Method for Quantum Dynamics", arxiv:2512.05185

2025 A.F. Mello, M. Collura, **E.M. Stoudenmire**, R. Levy, "Magic of the Well: assessing quantum resources of fluid dynamics data", arxiv:2512.03177

2025 J. Keeling, **E.M. Stoudenmire**, M.-C. Bañuls, D.R. Reichman, "Process Tensor Approaches to Non-Markovian Quantum Dynamics", arxiv:2509.07661

2025 J. Tindall, A. Mello, M. Fishman, **E.M. Stoudenmire**, D. Sels, "Dynamics of disordered quan-

tum systems with two-and three-dimensional tensor networks", arxiv:2503.05693

2024 J. Tindall, **E.M. Stoudenmire**, R. Levy, "Compressing multivariate functions with tree tensor networks", arxiv:2410.03572

2024 L. Ma, M.T. Fishman, J.H. Pixley, **E.M. Stoudenmire**, E. Solomonik, "Approximate Contraction of Arbitrary Tensor Networks with a Flexible and Efficient Density Matrix Algorithm", *Quantum* **8**, 1580

2024 A. Wu, B. Kloss, W. Krinitsin, M.T. Fishman, J.H. Pixley, **E.M. Stoudenmire**, "Disentangling interacting systems with fermionic Gaussian circuits: Application to quantum impurity models", *Phys. Rev. B* **111**, 035119

2024 **E.M. Stoudenmire**, Xavier Waintal "Opening the Black Box inside Grover's Algorithm", *Phys. Rev. X* **14**, 041029

2024 X. Cao, **E.M. Stoudenmire**, O. Parcollet, "Finite-temperature minimally entangled typical thermal states impurity solver", *Phys. Rev. B* **109**, 245113

2024 X. Cao, Y. Lu, **E.M. Stoudenmire**, O. Parcollet, "Dynamical correlation functions from complex time evolution", *Phys. Rev. B* **109**, 235110

2024 J. Chen, **E.M. Stoudenmire**, Y. Komijani, P. Coleman, "Matrix product study of spin fractionalization in the one-dimensional Kondo insulator", *Phys. Rev. Research* **6**, 023227

2024 Joseph Tindall, Matthew Fishman, **E.M. Stoudenmire**, Dries Sels, "Efficient Tensor Network Simulation of IBM's Eagle Kicked Ising Experiment", *Phys. Rev. X Quantum* **5**, 010308

2023 Jielun Chen, **E.M. Stoudenmire**, Steven R. White, "Quantum Fourier Transform Has Small Entanglement", *Phys. Rev. X Quantum* **4**, 040318

2023 Y. Hur, J. G. Hoskins, M. Lindsey, **E.M. Stoudenmire**, Y. Khoo, "Generative modeling via tensor train sketching", *Applied and Computational Harmonic Analysis* **67**, 101575

2022 Chunhan Feng, Alexander Wietek, **E.M. Stoudenmire**, Rajiv R. P. Singh, "Order, Disorder and Monopole Confinement in the Spin-1/2 XXZ Model on a Pyrochlore Tube", *Phys. Rev. B* **106**, 075135

2021 Daniel Bauernfeind, Xiaodong Cao, **E.M. Stoudenmire**, Olivier Parcollet, "Minimally Entangled Typical Thermal States Algorithms for Finite Temperature Matsubara Green Functions", arxiv:2107.13941

2021 Alexander Wietek, Riccardo Rossi, Fedor Šimkovic IV, Marcel Klett, Philipp Hansmann, Michel Ferrero, **E.M. Stoudenmire**, Thomas Schäfer, Antoine Georges, "Mott Insulating States with Competing Orders in the Triangular Lattice Hubbard Model", *Phys. Rev. X* **11**, 041013

2021 Justin Reyes, **E.M. Stoudenmire**, "Multi-Scale Tensor Network Architecture for Machine Learning", *Mach. Learning: Sci. Tech.* **2**: 035036

2021 Alexander Wietek, Yuan-Yao He, Steven R. White, Antoine Georges, **E.M. Stoudenmire**, "Stripes, Antiferromagnetism, and the Pseudogap in the Doped Hubbard Model at Finite Temperature", *Phys. Rev. X* **11**, 031007

2021 Peter Lunts, Antoine Georges, **E.M. Stoudenmire**, Matthew Fishman, "The Hubbard model

on the Bethe lattice via variational uniform tree states: metal-insulator transition and a Fermi liquid", *Phys. Rev. Research* **3**, 023054

2020 Matthew Fishman, **E.M. Stoudenmire**, Steven R. White, "The ITensor Software Library for Tensor Network Calculations",

2020 Yiqing Zhou, **E.M. Stoudenmire**, Xavier Waintal, "What limits the simulation of quantum computers?", *Phys. Rev. X* **10**, 041038 [Associated Physics Viewpoint Article]

2020 Mario Motta, Claudio Genovese, Fengjie Ma, Zhi-Hao Cui, Randy Sawaya, Garnet Kin-Lic Chan, Natalia Chepiga, Phillip Helms, Carlos Jimenez-Hoyos, Andrew J. Millis, Ushnish Ray, Enrico Ronca, Hao Shi, Sandro Sorella, **Edwin M. Stoudenmire**, Steven R. White, Shiwei Zhang,"Ground-state properties of the hydrogen chain: insulator-to-metal transition, dimerization, and magnetic phases", *Phys. Rev. X* **11**, 031058

2020 Tai-Danae Bradley, **E.M. Stoudenmire**, John Terilla, "Modeling Sequences with Quantum States: A Look Under the Hood", *Mach. Learn.: Sci. Technol.* **1**, 035008

2019 Jing Chen, **E.M. Stoudenmire**,"Hybrid Purification and Sampling Approach for Thermal Quantum Systems", *Phys. Rev. B* **101**, 195119

2019 Katharine Hyatt, **E.M. Stoudenmire**, "DMRG Approach to Optimizing Two-Dimensional Tensor Networks", arxiv:1908.08833

2018 Steven R. White, **E.M. Stoudenmire**, "Multisliced gausslet basis sets for electronic structure", *Phys. Rev. B* **99**, 081110(R)

2018 William Huggins, Piyush Patel, K. Birgitta Whaley, **E.M. Stoudenmire**, "Towards Quantum Machine Learning with Tensor Networks", *Quant. Sci. Tech.* **4**, 024001

2018 **E.M. Stoudenmire**, "Learning Relevant Features of Data with Multi-scale Tensor Networks", *Quant. Sci. Tech.* **3**, 034003

2017 William Huggins, C. Daniel Freeman, **E.M. Stoudenmire**, Norm M. Tubman, K. Birgitta Whaley, "Monte Carlo Tensor Network Renormalization", arxiv:1710.03757

2017 Benedikt Bruognolo, Zhenyue Zhu, Steven R. White, and **E.M. Stoudenmire**, "Matrix product state techniques for two-dimensional systems at finite temperature", arxiv:1705.05578

2017 Mario Motta, David M. Ceperley, **E.M. Stoudenmire**, et al., "Towards the solution of the many-electron problem in real materials: equation of state of the hydrogen chain with state-of-the-art many-body methods", *Phys. Rev. X* **7**, 031059

2017 **E.M. Stoudenmire** and Steven R. White, "Sliced Basis Density Matrix Renormalization Group for Electronic Structure", *Phys. Rev. Lett.* **119**: 046401

2016 **E.M. Stoudenmire** and D.J. Schwab, "Supervised Learning with Quantum-Inspired Tensor Networks", *Advances in Neural Information Processing Systems (NIPS)* **29**: 4799

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**]

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

Selected Research Talks

Feb 2025 Emory University Colloquium, *"Quantum Computing on Classical Machines with Tensor Networks"*.

Apr 2024 IBM New York, *"Classical Computing with Quantum Functions"*.

Sep 2023 NYU Colloquium, *"Quantum Computing on Classical Machines with Tensor Networks"*.

Sep 2022 ESI Vienna workshop, *"Disentangling Interacting Systems with Gaussian Tensor Networks"*.

Aug 2021 Flatiron Institute Seminar, *"Rivaling Near-Term Quantum Computers with Tensor Networks"*.

Jun 2021 Collège de France, *"Introduction and Perspective on Tensor Network Methods for Quantum Many-Body Physics"*. (Given remotely.)

Feb 2021 European Tensor Network Seminar, *"What Limits the Simulation of Quantum Computers?"*. (Given remotely.)

Oct 2020 CUNY Symposium on Quantum-Inspired Machine Learning, *"Perspective on Machine Learning with Tensor Networks"*. New York, NY. (Given remotely.)

Jun 2011 Weierstrass Institute, *"A Theory of Generative Modeling Using Matrix Product State Tensor Networks"*. Berlin, Germany.

Oct 2010 Asia Pacific Center for Theoretical Physics *"DMRG for 2D Systems and Advanced Topics"* and *"Tensor Networks for Machine Learning"*. Pohang, South Korea.

May 2019 Google X Bootcamp Lecture, *"Matrix Product State Tensor Networks for Data"*. Mountain View, CA.

Jun 2018 **Colloquium**, Max Planck Institute for Complex Systems, *"The inner life of the quantum wavefunction: tensor networks and their applications"*. Dresden, Germany.

Mar 2018 (Invited talk) APS March Meeting, *"Tensor Network Machine Learning Models"*. Los Angeles, CA.

Jan 2017 UBC, *"Sliced Basis Set Approach to Quantum Chemistry with DMRG"*. Vancouver, BC.

Nov 2016 CUNY Graduate Center Symposium, *"Machine Learning with Quantum-Inspired Tensor Networks"*. New York, NY.

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

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

Microsoft Station Q Seminar, *"Interaction Effects in Topological Superconducting Wires"*. Santa Barbara, CA.

L.A. Cond. Mat. Theory Meeting, *"DMRG Meets DFT"*. Pasadena, CA.

Invited Pedagogical Talks

Feb 2025 U. Mass. Amherst Colloquium, *"Quantum Computing on Classical Machines with Tensor Networks"*.

May 2025 SISSA, Trieste, Italy (Teaching), *"New Dimensions and Directions for Tensor Networks"*.

July 2025 Amherst (Teaching), *"The ITensor Software"*.

Sep 2025 ICTP, Trieste, Italy (Teaching), *"New Dimensions and Directions for Tensor Networks"*.

Sep 2025 MPI-PKS, Dresden, Germany (Teaching), *"New Dimensions and Directions for Tensor Networks"*.

2025 University of Jordan (Teaching), *"Tensor Networks for the Quantum Sciences and ML"*.

Apr 2024 ICTP School on Quantum Simulation and Machine Learning, Trieste, Italy, "Tensor Networks for Machine Learning". (Talk 1: Overview, Talk 2: TTRS Algorithm, Talk 3: TCI Algorithm).

Sep 2019 Autumn School on Correlated Electrons, Forschungzentrum Jülich, *"Tensor Networks for Ab Initio Quantum Systems"*. Jülich, Germany. Link to Book Chapter.

Apr 2018 One-week course on Tensor Networks, University of São Paulo, Brazil. Five lectures and four hands-on sessions. Poster link.

Jun 2017 & 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.

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 Guest Lecturer. UCI advanced undergraduate quantum mechanics and condensed matter physics (6 Lectures).

2008 Guest Lecturer. UCSB graduate condensed matter physics (4 Lectures).

Selected Activities and Contributed Talks

Feb 2026 **Organizer**. Quantum Dynamics with Quantum and Classical Computers, New York, NY.

Jan 2024 **Organizer**. International Quantum Tensor Network Workshop, New York, NY.

Jan 2019 **Organizer**. KITP Program on *Machine Learning for Quantum Many-Body Physics*.
Organizer. High School Teacher's Conference on Machine Learning.

Dec 2016 Neural Information Processing (NIPS) Conference, Barcelona. Poster: *"Learning with Quantum-Inspired Tensor Networks"*.

Aug 2016 **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"*

References available upon request