Itay Hen
Curriculum Vitae

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Education

- Ph.D. Physics, Tel-Aviv University (04/2009).
  Advisor: Prof. Marek Karliner.
- M.Sc. Physics, Tel-Aviv University, joined the direct Ph.D. program (2003). Advisor: Prof. Marek Karliner.
- B.Sc. Physics, Tel-Aviv University, magna cum laude (2002).
- B.A. Psychology, Tel-Aviv University (2002).

Academic and Research Positions

- **Principal Scientist** – Information Sciences Institute, University of Southern California, Los Angeles, CA (01/2022 –).
- **Supervising Computer Scientist** – Information Sciences Institute, University of Southern California, Los Angeles, CA (01/2022 –).
- **Adjunct Associate Professor (Research)** – Department of Physics and Astronomy, University of Southern California, Los Angeles, CA (07/2020 –).
- **Adjunct Assistant Professor (Research)** – Department of Physics and Astronomy, University of Southern California, Los Angeles, CA (07/2016 –06/2020).
- **Research Lead** – Information Sciences Institute, University of Southern California, Los Angeles, CA (08/2018 – 12/2021).
- **Computer Scientist** – Information Sciences Institute, University of Southern California, Los Angeles, CA (10/2013 – 12/2021).
- **Senior Research Scientist** – NASA Ames Research Center, Moffett Field, CA (08/2012 – 09/13).
  Research Associate – Physics Department, UC Santa Cruz, CA (08/2012 – 09/13).
- **Postdoctoral Fellow** – Theoretical Condensed Matter/Quantum Computing, UC Santa Cruz, CA (06/2010 – 07/2012). Advisor: Prof. Peter Young.
- **Postdoctoral Fellow** – Theoretical Condensed Matter, Georgetown University, Washington, DC (10/2008 – 05/2010). Advisor: Prof. Marcos Rigol.

Fields of interest

- Quantum computing and algorithms, Quantum simulations, Adiabatic quantum computing and quantum annealing.
- Foundations of Quantum Mechanics.
- Quantum phase transitions, Bose-Hubbard models, ultra-cold atoms in optical lattices.
- Quantum and classical Monte Carlo simulations. The QMC sign problem.
- Numerical and computational physics: Optimization techniques, many-body simulations, molecular dynamics, partial differential equations, multi-dimensional minimization algorithms.
- Topological solitons, spontaneous breaking of rotational symmetry in quantum field theories (thesis title).

Teaching (most recent)

- PHYS-516: Methods of Computational Physics, Physics – University of Southern California, Spring 2024.
- PHYS-510: Methods of Theoretical Physics, Physics – University of Southern California, Fall 2023.
- PHYS-438B: Introduction to Quantum Mechanics, Physics – University of Southern California, Fall 2021.

Funding (most recent)

- **Assessment of Quantum Utility EvaluateD Under Current Technologies (AQUEDUCT):** (DOE) – PI. Oct 23-Sep 27, $400K.
- **New phases of matter from quantum simulations of periodically driven systems** (DARPA) – PI. Sep 23-Sep 24, $300K.
- **BeQuEST: Benchmarking Quantum Enhancement in Science & Technology** (DARPA) – PI. Dec 21-Nov 26, $4.5M.
- **Resource Efficient Quantum Simulations on NISQ Devices: Advancing the State of the Art** (DOE) – PI. Sep 19-Sep 22, $1.05M.
- **QLEAK: A quantum algorithm for detecting quantum information leakage in qubit systems** (NSF) – Co-PI (PI: Amir Kalev). Jan 21-Dec 22. $200K.
- **OPTNISQ: Solving Optimization Problems on NISQ Computers** (NSF) – Co-PI (PI: Amir Kalev). Sep 20-Aug 22, $300K.
- **Quantum annealing feasibility study/Quantum enhanced optimization** (DARPA/IARPA) – Task leader (PI: Daniel Lidar). $4.6M.
- **Q4Q: Quantum Computation for Quantum Prediction of Materials and Molecular Properties** – Co-PI (PI: Rosa Di Felice). Dec 21-Nov 24, $650K.
- **Towards Enhanced Quantum Annealing in Learning and Simulation** (DARPA) – Co-PI (PI: Daniel Lidar). Apr 21-Oct 22, $1.6M.
- **Software Stack and Algorithms for Automating Quantum Classical Computing** (DOE) – Institutional PI (PI: Eugene Dumitrescu, ORNL). Dec 18-Oct 22. $415K.

Editorial boards

- Editorial Board Member: Physical Review A
- Associate Editor: ACM Transactions on Quantum Computing
- Editorial Board Member: Scientific Reports
- Academic Editor: PLOS ONE
- Editorial Board Member: Entropy
- Review Editor: Frontiers in ICT

Journal Refereeing

- Nature, Nature Physics, Nature Communications, Nature Nanotechnology, Scientific Reports
- PNAS
- Physical Review A, B, E, X, X Quantum, Letters, Applied, Research
- npj Quantum Information
- IEEE Access, IEEE Transactions on Systems, Man and Cybernetics: Systems, IEEE Transactions on Quantum Engineering
- Quantum Science and Technology
- Quantum
- New Journal of Physics
- Quantum Information Processing
- Journal of Physics A: Mathematical and Theoretical, Journal of Physics B: Atomic, Molecular and Optical Physics
- Europhysics Letters
- Journal of Computer Science and Technology
- Physics Letters A
- Annalen der Physik
- Entropy, Applied Sciences.
- Canadian Journal of Physics
- Journal of Statistical Physics
- JSTAT: Journal of Statistical Mechanics: theory and experiment
- Frontiers in Physics
- European Physical Journal D
- Theory and Practice of Logic Programming
- Open Systems and Information Dynamics
- Advanced Quantum Technologies
- Journal of Mathematical Analysis and Applications
- Computers and Electrical Engineering
- Reports on Mathematical Physics
- Quantum Machine Intelligence
- Journal of Computational Science
- Communications Physics
- ACM Transactions on Quantum Computing
- PLOS ONE
- Entropy
- Advanced theory and simulations
- Quantum Information & Computation
- IET Radar, Sonar & Navigation

List of publications (most recent)

(1) E. Akaturk and I. Hen, "A quantum Monte Carlo algorithm for Bose-Hubbard models on arbitrary graphs", accepted for publication in Phys. Rev. B. arXiv:2309.05166 (2023).

(2) L. Barash, A. Babakhani and I. Hen, "A quantum Monte Carlo algorithm for arbitrary spin-1/2 Hamiltonians", Phys. Rev. Research 6, 013281 (2024). arXiv:2307.06503 (2023).

(3) K. J. Ferris, Z. Wang, N. T. Bronn, I. Hen, A. Kalev and V. Vlček, "Experimental Demonstration of Quantum Spectrum Estimation by Time-Correlation Measurements", submitted for publication, arXiv:2312.00687 (2023).

(4) M. Kowalsky, T. Albash, I. Hen and D. A. Lidar, "3-Regular 3-XORSAT Planted Solutions Benchmark of Classical and Quantum Heuristic Optimizers", Quantum Sci. Technol. 7 025008 (2022). arXiv:2103.08464.

(5) L. Barash, S. Güttel and I. Hen, "Calculating elements of matrix functions using divided differences", Computer Physics Communications 271, 108219 (2022). arXiv:2107.14124.

(6) J. L. C. da C. Filho, Z. G. Izquierdo, A. Saguia, T. Albash, I. Hen, and M. S. Sarandy, "Localization transition induced by programmable disorder", Phys. Rev. B. 105, 134201 (2022). arXiv:2108.06762 (2021).

(7) D. Oaknin, A. Kalev and I. Hen, "Bell-type games on deformable manifolds", arXiv:2111.14228 (2021).

(8) G. Quiroz, P. Titum, P. Lotshaw, P. Lougovski, K. Schultz, E. Dumitrescu and I. Hen, "Quantifying the Impact of Precision Errors on Quantum Approximate Optimization Algorithms". arXiv:2109.04482 (2021).

(9) T. Halverson, L. Gupta, M. Goldstein and I. Hen, "Efficient simulation of so-called non-stoquastic superconducting flux circuits", submitted for publication. arXiv:2011.03831 (2020).

(10) Y.-H. Chen, A. Kalev, and I. Hen, "A quantum algorithm for time-dependent Hamiltonian simulation by permutation expansion", PRX Quantum 2, 030342 (2021). arXiv:2103.15334 (2021).

(11) A. Kalev, and I. Hen, "An integral-free representation of the Dyson series using divided differences", New J. Phys. 23, 103035 (2021). arXiv:2010.09888.

(12) Z. Gonzalez Izquierdo, T. Albash and I. Hen, "Testing a quantum annealer as a quantum thermal sampler", ACM Transactions on Quantum Computing 2/7, 1-20. arXiv:2003.00361 (2020).

(13) I. Hen, "Determining quantum Monte Carlo simulability with geometric phases", Physical Review Research 3, 023080 (2021). arXiv:2012.02022 (2020).

(14) A. Kalev, and I. Hen, "Quantum Algorithm for Simulating Hamiltonian Dynamics with an Off-diagonal Series Expansion", Quantum 5, 426 (2021). arXiv:2006.02539 (2020).

(15) E. Crosson, T. Albash, I. Hen, and A. P. Young, "De-Signing Hamiltonians for Quantum Adiabatic Optimization", Quantum 4, 334 (2020). arXiv:2004.07681.

(16) Z. Gonzalez Izquierdo, R. Zhou, K. Markström and I. Hen, "Discriminating Non-Isomorphic Graphs with an Experimental Quantum Annealer", Phys. Rev. A 102, 032622. arXiv:2003.00361 (2020).

(17) L. Gupta, T. Albash and I. Hen, "Permutation Matrix Representation Quantum Monte Carlo", J. Stat. Mech. 073105 (2020). arXiv:1908.03740.

(18) J. Klassen, M. Marvian, S. Piddock, M. Ioannou, I. Hen and B. Terhal, "Hardness and Ease of Curing the Sign Problem for Two-Local Qubit Hamiltonians", SIAM J. Comput., 49(6), 1332–1362 (2020). arXiv:1906.08800.

(19) L. Gupta, L. Barash and I. Hen, "Calculating the divided differences of the exponential function by addition and removal of inputs", Computer Physics Communications **254**, 107385 (2020). arXiv:1912.12157 (2019).
(20) L. Gupta and I. Hen, "Elucidating the interplay between non-stoquasticity and the sign problem", Advanced Quantum Technologies. arXiv:1910.13867 (2019).
(21) A. Pearson, A. Mishra, I. Hen and D. Lidar, "Analog Errors in Quantum Annealing: Doom and Hope", npj Quantum Information **5**, 107 (2019). arXiv:1907.12678 (2019).
(22) M. Slutskii, T. Albash, L. Barash and I. Hen, "Analog Nature of Quantum Adiabatic Unstructured Search", New Journal of Physics **21**, 113025 (2019). arXiv:1904.04420.
(23) L. Barash, J. Marshall, M. Weigel and I. Hen, "Estimating the Density of States of Frustrated Spin Systems", New Journal of Physics **21**, 073065 (2019). arXiv:1808.04340.
(24) I. Hen, "Equation Planting: A Tool for Benchmarking Ising Machines", Phys. Rev. Applied **12**, 011003 (2019). arXiv:1903.10928.
(25) T. Albash and I. Hen, Future of physical quantum annealers: impediments and hopes, Science and Culture **85** 163-170 (2019).
(26) I. Hen, "How quantum is the speedup in adiabatic unstructured search?", Quant. Inf. Proc. **18**, 162 (2019). arXiv:1811.08302.
(27) J. Marshall, D. Venturelli, I. Hen and E. G. Rieffel, "The power of pausing: advancing understanding of thermalization in experimental quantum annealers", Phys. Rev. Applied **11**, 044083 (2019). arXiv:1810.05881.
(28) T. Albash, V. Martin-Mayor and I. Hen, "Analog Errors in Ising Machines", Quantum Science & Technology **4** 02LT03 (2019). arXiv:1806.03744.
(29) I. Hen, "Resolution of the Sign Problem for a Frustrated Triplet of Spins", Phys. Rev. E **99**, 033306 (2019). arXiv:1811.03027.
(30) M. Marvian, D. A. Lidar and I. Hen, "On the Computational Complexity of Curing Non-Stoquastic Hamiltonians", Nature Communications **10**, 1571 (2019). arXiv:1802.03408.
(31) Y. Susa, Y. Yamashiro, M. Yamamoto, I. Hen, D. Lidar and H. Nishimori,"Quantum annealing of the p-spin model under inhomogeneous transverse field driving", Phys. Rev. A **98**, 042326 (2018). arXiv:1808.01582
(32) I. Hen and T. Albash, "Solving Quantum Spin Glasses with Off-Diagonal Expansion Quantum Monte Carlo", Journal of Physics: Conference Series (JPCS) **1136**, 012007 (2018).
(33) I. Hen, "Off-Diagonal Series Expansion for Quantum Partition Functions", J. Stat. Mech 053102 (2018). arXiv:1802.08333.
(34) B. Zhang, G. Wagenbreth, V. Martin-Mayor and I. Hen, "Advantages of unfair quantum ground-state sampling", Scientific Reports **7**, 1044 (2017). arXiv:1701.01524.
(35) I. Hen, "Realizable quantum adiabatic search", Europhysics Letters **118**, 30003 (2017). arXiv:1612.06012.
(36) I. Hen, "Solving spin glasses with optimized trees of clustered spins", Phys. Rev. E **96**, 022105 (2017). arXiv:1705.02075.
(37) T. Albash, V. Martin-Mayor and I. Hen, "Temperature scaling law for quantum annealing optimizers", Phys. Rev. Lett. **119**, 110502 (2017), arXiv:1703.03871.
(38) J. Marshall, E. Rieffel and I. Hen, "Thermalization, freeze-out and noise: deciphering experimental quantum annealers", Phys. Rev. Applied **8**, 064025 (2017). arXiv:1703.03902.
(39) T. Albash, G. Wagenbreth and I. Hen, "Off-diagonal expansion quantum Monte Carlo". Phys. Rev. E **96**, 063309 (2017). arXiv:1701.01499.
(40) I. Hen and F. M. Spedalieri, "Quantum annealing for constrained optimization", Phys. Rev. Applied **5**, 034007 (2016). arXiv:1508.04212.

(41) I. Hen and M. S. Sarandy, "Driver Hamiltonians for constrained optimization in quantum annealing", Phys. Rev. A **93**, 062312 (2016). arXiv:1602.07942.
(42) J. Marshall, V. Martin-Mayor and I. Hen, "Practical Engineering of Hard Spin-Glass Instances", Phys. Rev. A **94**, 012320 (2016). arXiv:1605.03607.
(43) I. B. Coulamy, A. C. Santos, I. Hen and M. S. Sarandy, "Energetic cost of superadiabatic quantum computation", Frontiers in ICT **3**, 19 (2016). arXiv:1603.07778.
(44) I. Hen and A. P. Young, "Performance of the quantum adiabatic algorithm on constraint satisfaction and spin glass problems", European Physical Journal Special Topics **224**, 63-73 (2015).
(45) I. Hen, "Quantum gates with controlled adiabatic evolutions", Phys. Rev. A **91**, 022309 (2015). arXiv:1401.5172.
(46) A. Kalev and I. Hen, "Fidelity-optimized quantum state estimation", New Journal of Physics **17** 092008 (2015). arXiv:1409.1952.
(47) I. Hen and A. P. Young, "Numerical Studies of the Quantum Adiabatic Algorithm, and spin glass problems", Proceedings of CCP2014, J. Phys.: Conf. Ser. **640**, 012038 (2015).
(48) V. Martin-Mayor and I. Hen, "Unraveling Quantum Annealers using Classical Hardness", Scientific Reports **5**, 15324 (2015). arXiv:1502.02494.
(49) I. Hen, J. Job, T. Albash, Troels F. Roennow, M. Troyer, D. A. Lidar, "Probing for quantum speedup in spin glass problems with planted solutions", Phys. Rev. A **92**, 042325 (2015). arXiv:1502.01663.
(50) W. Vinci, T. Albash, G. Paz-Silva, I. Hen and D. A. Lidar, "Quantum annealing correction with minor embedding", Phys. Rev. A **92**, 042310 (2015). arXiv:1507.02658.
(51) T. Albash, I. Hen, F. M. Spedalieri and D. A. Lidar, "Reexamination of the evidence for entanglement in the D-Wave processor", Phys. Rev. A **92**, 062328 (2015). arXiv:1506.03539.
(52) I. Hen, "How Fast Can Quantum Annealers Count?", J. Phys. A: Math. Theor. **47**, 235304 (2014). arXiv:1301.4956.
(53) I. Hen, "Continuous-Time Quantum Algorithms for Unstructured Problems", J. Phys. A: Math. Theor. **47**, 045305 (2014). arXiv:1302.7256
(54) I. Hen, "Period finding with Adiabatic Quantum Computation", Europhysics Letters **105**, 50005 (2014). arXiv:1307.6538.
(55) E. G. Rieffel, M. Do, D. Venturelli, I. Hen and J. Franks, "Phase Transitions in Planning Problems: Design and Analysis of Parameterized Families of Hard Planning Problems", AAAI 2014: 2337-2343 (2014).
(56) I. Hen, "Fourier-transforming with quantum annealers". Front. Phys. **2**, 44 (2014).
(57) I. Hen, "Excitation Gap from Optimized Correlation Functions in Quantum Monte Carlo Simulations", Phys. Rev. E **85**, 036705 (2012). arXiv:1112.2269.
(58) I. Hen and A. P. Young, "Solving the Graph Isomorphism Problem with a Quantum Annealer", Phys. Rev. A **86**, 042310 (2012). arXiv:1207.1712.
(59) E. Farhi, D. Gosset, I. Hen, A. W. Sandvik, P. Shor, A. P. Young, and F. Zamponi, "The performance of the quantum adiabatic algorithm on 3 Regular 3XORSAT and 3 Regular Max-Cut", Phys. Rev. A **86**, 052334 (2012). arXiv:1208.3757.
(60) l. Hen and A. P. Young, "Exponential Complexity of the Quantum Adiabatic Algorithm for certain Satisfiability Problems", Phys. Rev. E **84**, 061152 (2011). arXiv:1109.6872.
(61) I. Hen and M. Rigol, "Strongly interacting atom lasers in three dimensional optical lattices", *Phys. Rev. Lett.* **105**, 180401 (2010). arXiv:1010.5553.

(62) I. Hen and M. Rigol, "Analytical and numerical study of trapped strongly correlated bosons in two- and three-dimensional lattices", *Phys. Rev. A* **82**, 043634 (2010). arXiv:1005.1915.
(63) I. Hen, M. Iskin and M. Rigol, "Phase diagram of the hardcore Bose-Hubbard model on a checkerboard superlattice", *Phys. Rev. B* **81**, 064503 (2010). arXiv:0911.0890.
(64) F. Alexander Wolf, I. Hen and M. Rigol, "Collapse and revival oscillations as a probe for the tunneling amplitude in an ultracold Bose gas", *Phys. Rev. A* **82**, 043601 (2010). arXiv:1010.1776.
(65) I. Hen and M. Karliner, "Review of rotational symmetry breaking in baby Skyrme models", in G. Brown and M. Rho, Eds., *The Multifaceted Skyrmion*, (World Scientific, Singapore, 2010).
(66) I. Hen and M. Rigol, "Superfluid to Mott-insulator transition of hardcore bosons in a superlattice", *Phys. Rev. B* **80**, 134508 (2009). arXiv:0905.4920.
(67) I. Hen and M. Karliner, "Lattice structure of baby skyrmions", *Theoretical and Mathematical Physics* **160(1)**, 934 (2009).
(68) I. Hen and A. Kalev, "Equations of motion for the quantum characteristic functions", arXiv:0803.0108 (2008).
(69) I. Hen and M. Karliner, "Rotational symmetry breaking in baby Skyrme models", *Nonlinearity* **21**, 399 (2008). arXiv:0901.1489.
(70) A. Kalev and I. Hen, "No-broadcasting theorem and its classical counterpart", *Phys. Rev. Lett.* **100**, 210502 (2008). arXiv:0704.1754.
(71) I. Hen and M. Karliner, "Spontaneous breaking of rotational symmetry in rotating solitons: a toy model of excited nucleons with high angular momentum", *Phys. Rev. D* **77**, 116002 (2008). arXiv:0802.2348.
(72) I. Hen and M. Karliner, "Baby skyrmions on the two-sphere", *Phys. Rev. E* **77**, 036612 (2008). arXiv:0711.1974.
(73) I. Hen and M. Karliner, "Hexagonal structure of baby skyrmion lattices", *Phys. Rev. D* **77**, 054009 (2008). arXiv:0711.2387.
(74) I. Hen and A. Kalev, "Classical states and their quantum correspondence", arXiv:quant-ph/0701015 (2007).
(75) H. Braunstein-Bercovitz, I. Hen and R. E. Lubow, "Masking task load modulates latent inhibition", *Cognition and Emotion* **18**, 1135 (2004).
(76) I. Hen, A. Sakov, N. Kafkafi, I. Golani and Y. Benjamini, "The dynamics of spatial behavior: how can robust smoothing techniques help?", *Journal of Neuroscience Methods* **133**, 161 (2004).

Conference and seminar talks:

- *"Hexagonal Structure of Baby Skyrmion Lattices"*, Israel Physical Society, Weizmann Institute of Science, Rehovot, Israel, December 2007 (conference talk).
- *"Hexagonal Structure of Baby Skyrmion Lattices"*, Integrable Systems Seminar, University of Leeds, Leeds, UK, March 2008 (seminar talk).
- *"Spontaneous Breaking of Rotational Symmetry in Field Theory Solitons"*, Particle Physics Seminar, Tel-Aviv University, Tel-Aviv, Israel, June 2008 (seminar talk).
- *"Hexagonal Structure of Baby Skyrmion Lattices"*, Nonlinear Physics: Theory and Experiment V, Gallipoli, Italy, June 2008 (conference talk).
- *"Superfluid to Mott-insulator Transition of Hardcore Bosons in a Superlattice"*, Condensed Matter Physics Seminar, Georgetown University, Washington DC, March 2009 (seminar talk).

- *"Superfluid to Mott-insulator Transition of Hardcore Bosons in a Superlattice"*, APS March Meeting, Pittsburgh, PA, March 2009 (conference talk).
- *"Superfluid to Mott-insulator Transition of Hardcore Bosons in a Superlattice"*, Condensed Matter Physics Seminar, Georgetown University, Washington DC, May 2009 (seminar talk).
- *"No-Broadcasting Theorem and Its Classical Counterpart"*, 2nd Vienna Symposium on the Foundations of Modern Physics, Vienna, Austria, June 2009 (poster).
- *"Phase Diagram of the Hardcore Bose-Hubbard Model in the Presence of a Superlattice"*, Quantum Information/Bose-Einstein Condensation Seminar, NIST, Gaithersburg, MD, December 2009 (seminar talk).
- *"Phase Diagram of the Hardcore Bose-Hubbard Model in the Presence of a Superlattice"*, Condensed Matter Physics Seminar, Georgetown University, Washington DC, November 2009 (seminar talk).

- *"Phase Diagram of the Hardcore Bose-Hubbard in the Presence of a Superlattice"*, AMOPP group talk, University College London, London, UK, January 2010 (Job talk).
- *"Phase Diagram of the Hardcore Bose-Hubbard Model in the Presence of a Superlattice"*, Condensed Matter Seminar, UC Santa Cruz, Santa Cruz, CA, January 2010 (seminar talk).
- *"Phase Diagram of the Hardcore Bose-Hubbard Model in the Presence of a Superlattice"*, APS March Meeting, Portland, OR, March 2010 (conference talk).
- *"No-Broadcasting Theorem and Its Classical Counterpart"*, ARO/ NSA 2010 Quantum Computing, Quantum Algorithms & Multi-Qubit Coherent Operations Program Review, Cincinnati, OH, August 2010 (poster).
- *"Phase Diagram of Hardcore Bose-Hubbard Model in the Presence of a Superlattice"*, Condensed Matter Seminar, Boston University, Boston, MA, November 2010 (seminar talk).

- *"Strongly Interacting Atom Lasers in 3D Optical Lattices"*, 2011 Mini Stat Mech Meeting, UC Berkeley, Berkeley, CA, January 2011 (poster).
- *"Implementation of the Quantum Adiabatic Algorithm"*, Farhi Group Meeting, MIT, Cambridge, MA, February 2011 (Informal seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, ARO/ NSA 2011 Quantum Computing and Quantum Algorithms Program Review, Denver, CO, August 2011 (poster).
- *"Complexity of the Quantum Adiabatic Algorithm"*, International Workshop on Simulation and Manipulation of Quantum Systems for Information Processing, Jülich, Germany, October 2011 (poster).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Weizmann Institute of Science, Rehovot, Israel, November 2011 (seminar talk).

- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Ben-Gurion University, Beer Sheva, Israel, December 2011 (seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Bar-Ilan University, Ramat Gan, Israel, December 2011 (seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Tel Aviv University, Tel Aviv, Israel, December 2011 (seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Hebrew University, Jerusalem, Israel, December 2011 (seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Rutgers Center for Materials Theory, Piscataway, NJ, December 2011 (seminar talk).

- *"Complexity of the Quantum Adiabatic Algorithm"*, 2012 Mini Stat Mech Meeting, UC Berkeley, Berkeley, CA, January 2012 (poster).
- *"Complexity of the Quantum Adiabatic Algorithm"*, First NASA Quantum Future Technologies Conference, Moffett Field, CA, January 2012 (poster).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Quantum Computing Group Seminar, LPS, College Park, MD, January 2012 (seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, APS March Meeting, Boston, MA, February 2012 (conference talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, NASA Space Research Expo, Moffett Field, CA, March 2012 (poster).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, UC Santa Cruz, Santa Cruz, CA, April 2012 (seminar talk).
- *"Adiabatic Quantum Computing"*, Advanced Machine Learning Class, UC Santa Cruz, Santa Cruz, CA, June 2012 (tutorial).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Workshop on Complex quantum systems: Nonergodicity, glassiness and localization, The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, August 2012 (invited talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Condensed Matter Seminar, Universidad Complutense de Madrid, Madrid, Spain, September 2012 (seminar talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, Quantum Information Laboratory Workshop, NASA Ames research center, Moffett Field, CA, November 2012 (seminar talk).

- *"Some New Quantum Adiabatic Algorithms"*, AQC 2013 – 2nd International Workshop on Adiabatic Quantum Computing, London, UK, March 2013 (conference talk).
- *"Complexity of the Quantum Adiabatic Algorithm"*, APS March Meeting, Baltimore, MD, March 2013 (invited talk).
- *"Harnessing Adiabatic Quantum Computing for Operational Planning Problems"*, NASA-Ames QuAIL Seminar, Moffett Field, CA, June 2013 (seminar talk).
- *"Harnessing Adiabatic Quantum Computing for Operational Planning Problems"*, 2nd D-Wave Application Colloquium, ISI/USC, Marina del Rey, CA, June 2013 (invited talk).
- *"Programming the D-Wave Chip"*, NASA Ames Research Center, Moffett Field, CA, August 2013.
- *"New Quantum Adiabatic Algorithms"*, Quantum Computing Meetup Group, Mountain View, CA, October 2013 (invited talk).
- *"Period Finding with Adiabatic Quantum Computation"*, Daniel Lidar's Group Meeting, University of Southern California, Los Angeles, CA, October 2013.
- *"Hardness of D-Wave-specific problems with planted solutions"*, Google's Quantum Computing Group, Venice–Los Angeles, CA, December 2013.

- *"Hardness of D-Wave-specific problems with planted solutions"*, Daniel Lidar's Group Meeting, University of Southern California, Los Angeles, CA, December 2013.
- *"Period Finding and other Quantum Adiabatic Algorithms"*, Condensed Matter Seminar, Ben-Gurion University, Beer Sheva, Israel, December 2013 (seminar talk).

- *"Period Finding and other Quantum Adiabatic Algorithms"*, Quantum Seminar, Tel Aviv University, Tel Aviv, Israel, January 2014 (seminar talk).
- *"Hardness of D-Wave-specific problems with planted solutions"*, QRA/Lockheed-Martin/USC Meeting, University of Southern California, Los Angeles, CA, January 2014.
- *"Quantum Adiabatic Circuits"*, 3rd D-Wave Application Colloquium, Google, Venice, CA, January 2014.
- *"Power of Adiabatic Quantum Computation"*, Physics Colloquium, University of Southern California, Los Angeles, CA, February 2014 (colloquium).
- *"Controlled Quantum Adiabatic Evolution"*, Quantum Control MURI retreat, Laguna Beach, CA, February 2014.
- *"Period Finding with Adiabatic Quantum Computation"*, SQuInT (Southwest Quantum Information and Technology), Santa Fe, NM, February 2014 (conference talk).
- *"Period Finding with Adiabatic Quantum Computation"*, APS March Meeting, Denver, CO, March 2014.
- *"Period Finding with Adiabatic Quantum Computation"*, Aspen Winter Conference on Advances in Quantum Algorithms and Computation, Aspen, CO, March 2014 (invited talk).
- *"Performance of D-Wave Two on Problems with Planted Solutions"*, AQC 2014, Los Angeles, CA, June 2014 (invited talk).
- *"Performance of D-Wave Two on Problems with Planted Solutions"*, Google Quantum Group Seminar, Google, Venice, CA, June 2014.
- *"Quantum Computational Science"*, 2014 OLCF Users Meeting, Oak Ridge, TN, July 2014 (invited talk).
- *"Optimization via Open System Quantum Annealers"*, ARO Program Review, Arlington VA, August 2014.
- *"Quantum versus Thermal Annealing: Seeking a Fair Comparison"*, Workshop on heuristic and quantum-inspired optimization, Zurich, Switzerland, August 2014 (invited talk).
- *"Performance of D-Wave Two on Problems with Planted Solutions"*, Practical Applications of Quantum Annealing Workshop, Griffiss Air Force Base, Rome, NY, September 2014 (invited talk).
- *"Quantum versus Thermal Annealing: Seeking a Fair Comparison"*, D-Wave Users Colloquium, Sunnyvale, CA, September 2014 (invited talk).
- *"Quantum Speedups with D-Wave Two"*, Lawrence Livermore National Laboratory, Livermore, CA, October 2014 (seminar talk).
- *"Role of Classical Hardness for Quantum Annealers"*, Peter Young Retirement Conference, Santa Cruz, CA, February 2015 (invited talk).

- *"Effects of Classical Control Errors on the Performance of Quantum Annealers"*, Quantum Control MURI Retreat, Huntington Beach, CA, February 2015.
- *"Near-Future Quantum Advantages Beyond Speedup"*, ASCR Workshop on Quantum Computing for Science, Bethesda, MD, February 2015 (invited talk).
- *"Classical Simulations of Large-Scale Quantum Computers"*,ASCR Workshop on Quantum Computing for Science, Bethesda, MD, February 2015 (invited talk).
- *"Role of Classical Hardness for Quantum Annealers"*, SQuInT (Southwest Quantum Information and Technology), Berkeley, CA, February 2015 (conference talk).
- *"Role of Classical Hardness for Quantum Annealers"*, APS March Meeting, San Antonio, TX, March 2015.

- *"Harnessing Spin-Glass Theory to Probe Quantum Annealers"*, Condensed-Matter seminar, Bar-Ilan University, Ramat Gan, Israel, April 2015 (seminar talk).
- *"Optimized Adaptive Tomography"*, Daniel Lidar's Group Meeting, University of Southern California, Los Angeles, CA, April 2015.
- *"Power of Adiabatic Quantum Computation: Theory and Reality"*, Physics Seminar, San Jose State University, San Jose CA, April 2015.
- *"Power of Adiabatic Quantum Computation: Theory and Reality"*, QCD: from Theory to Experiment (symposium in honor of Marek Karliner's 60th birthday), Tel Aviv University, Tel Aviv, Israel, May 2015 (invited talk).
- *"Generating hard problems on the Chimera"*, Fourth Conference in Adiabatic Quantum Computing, ETH Zurich, Switzerland, June 2015.
- *"Quantum Annealing for Constrained Optimization"*, D-Wave/Lockheed-Martin/USC Meeting, University of Southern California, Los Angeles, CA, September 2015.
- QEO proposers' day, IARPA, College Park, MD, October 2015.
- *R&D in Computing*, Rethink Disruption CTO Forum, San Francisco, CA, November 2015 (panelist, invited).
- *"Simulations, modeling and benchmarking of experimental quantum annealing optimizers"*, SC15 (USC booth), Austin, TX, November 2015.
- *"Fidelity-optimized quantum state estimation"*, Neural Information Processing Systems (NIPS) 2015, Montreal, CA, December 2015.

- *"Quantum Annealing for Constrained Optimization"*, SQuInT (Southwest Quantum Information and Technology), Santa Fe, NM, February 2016 (conference talk).
- *"Quantum Annealing for Constrained Optimization"*, Google Quantum Group meeting, Venice, CA, March 2016.
- *"Quantum Annealing for Constrained Optimization"*, APS March meeting, Baltimore, MD, March 2016.
- *"Practical Engineering of Hard Spin-Glass Instances"*, Daniel Lidar's Group Meeting, University of Southern California, Los Angeles, CA, May 2016. .
- *"Classical Modeling of Quantum Tunneling"*, Adiabatic Quantum Computing Conference, Venice, CA, June 2016.
- *"Temperature chaos, J-chaos and the like in quantum annealers"*, NASA Ames Research Center, Moffett Field, CA, August 2016.
- *"Role of classical hardness for quantum annealers"*, Berkeley Quantum Information and Computation Center, Berkeley, CA, August 2016.
- *"Quantum-Classical Hybrid Monte Carlo Algorithms with Applications to AQC"*, Workshop on Theory and Practice of Adiabatic Quantum Computers and Quantum Simulation, The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, August 2016 (invited).
- *"A Scaling Law for Dilution Fridges"*, Lockheed Martin/D-Wave/USC technical exchange meeting, Marina del Rey, CA, October 2016.
- *"Probing Analog Quantum Annealers with High Performance Computers"*, SC16 (USC booth), Salt Lake City, UT, November 2016.
- *"The fair in unfair quantum ground state sampling"*, AGU meeting, San Francisco, CA, December 2016 (poster).

- *"The fair in unfair quantum ground state sampling"*, Daniel Lidar's group meeting, Los Angeles, CA, January 2017.
- *"Quantum annealers: Past and Future"*, ISI's CS&T Monthly meeting, Marina del Rey, CA, January 2017.
- *"Realizable quantum adiabatic search"*, SQuInT (Southwest Quantum Information and Technology), Baton Rouge, Louisiana, February 2017 (poster).

- *"Thermalization, freeze-out and J-chaos: deciphering experimental quantum annealers"*, APS March Meeting, New Orleans, Louisiana, March 2017 (conference talk).
- *"Beyond HFS"*, Lockheed Martin/D-Wave/USC technical exchange meeting, Marina del Rey, CA, April 2017.
- *"Quantum Computing at ISI: D-Wave and Beyond"*, Air Force Space Command SMC visit, Marina del Rey, CA, April 2017.
- *"Power of Adiabatic Quantum Computing: Theory and Reality"*, Dahlem Center Colloquium, Dahlem Center for Complex Quantum Systems — Free University of Berlin, Berlin, Germany, June 2017.
- *"Limitations of Physical Quantum Annealers"*, AQC 2017 – 5th International Workshop on Adiabatic Quantum Computing, Tokyo, Japan, June 2017 (invited).
- *"Off-diagonal Expansion Quantum Monte Carlo"*, Conference of Computational Physics 2017, Paris, France, July 2017.
- *"Understanding Analog Quantum Computers with Digital Supercomputers "*, CECAM Workshop — Synergy between quantum computing and high-performance computing, Zurich, Switzerland, August 2017 (invited).
- *"Power of Adiabatic Quantum Computing: Theory and Reality"*, Physics Colloquium, Universidade Federal Fluminense, Niteroi, RJ, Brasil, October 2017.
- *"Limitation of and Hopes for Physical Quantum Annealers"*, Quantum Information Seminar, Universidade Federal Fluminense, Niteroi, RJ, Brasil, October 2017.
- *"Quantum Enhancement"*, QEO Kickoff Meeting, San Diego, CA, October 2017.
- *"Searching for Optimal Quantum Annealing Architectures"*, QEO Kickoff Meeting, San Diego, CA, October 2017.
- *"Limitation of and Hopes for Physical Quantum Annealers"*, DARPA/MEC Quantum Applications Workshop, Berkeley, CA, November 2017 (invited).
- *"Different Facets of Benchmarking"*, QEO Technical Exchange Meeting, Moffett Field, CA, February 2018.
- *"Can Analog Quantum Computers Solve Spin Glasses?"*, APS March Meeting, Los Angeles, CA, March 2018 (invited).
- *"Off-Diagonal Series Expansion for Quantum Partition Functions"*, Daniel Lidar's group meeting, Los Angeles, CA, April 2018.
- *"Quantum Annealers as Substitutes to QMC Algorithms"*, D-Wave/L,CO/USC Technical exchange meeting, Marina del Rey, CA, April 2018.
- *"Future of Analog Quantum Computing and ISI's Role in It"*, CS&T monthly meeting, Marina del Rey, CA, April 2018.
- *"Solving NP-hard problems with Janus"*, Janus Collaboration meeting, Madrid, Spain, June 2018.
- *"Analog Errors in Ising Machines"*, NASA Ames research center, Moffett Field, CA, June 2018.
- *"Quantum Annealers as QMC Substitutes"*, AQC 2018, Moffett Field, CA, June 2018.
- *"Quantum Enhancements Task One Year Review"*, QEO Review Meeting 2018, Moffett Field, CA, June 2018.
- *"Analog Quantum Computers: Hopes and Limitations"*, HPC workshop, Cetraro, Italy, July 2018 (invited).
- *"Probing Analog Quantum Machines with Supercomputer Simulations"*, Computer Simulations in Physics and Beyond (3rd International Conference), Moscow, Russia, September 2018 (invited).
- *"A Center for Quantum Simulations"*, USC Quantum Center brainstorming workshop, Los Angeles, CA, November 2018.
- *"Quantum Annealing, Analog Errors, Quantum Simulations and more"*, ASCR DOE QCAT Kickoff Meeting, Online Meeting, November 2018.

- *"Paths to quantum enhancements."*, QEO Program Review, San Diego, CA, January 2019.
- *"Center for Quantum Simulations"*, DOE QIS Kickoff Meeting, Bethesda, MD, January 2019.
- *"Off-diagonal series expansion quantum Monte Carlo"*, APS March meeting, Boston, MA, March 2019.
- *"Errors in Analog Quantum Computers"*, Virtual meeting on error mitigation for near-term QCs, March 2019.
- *"Equation Planting: A Tool for Benchmarking Ising Machines*, Daniel Lidar's group meeting, Los Angeles, CA, March 2019.
- *"Off-Diagonal Series Expansion: From QMC to Hamiltonian Simulation"*, STAQC Application Team, April 2019.
- *"Quantum Enhancement: Progress Report and Outlook"*, QEO MIT LL site visit, Boston, MA, April 2019.
- *"Quantum Computing at ISI"*, What's Going On Breakfast Meeting at ISI, Marina del Rey, CA, April 2019.
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, Condensed Matter Seminar, Tel Aviv University, Tel Aviv, Israel, April 2019.
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, Quantum Optics Seminar, Bar-Ilan University, Ramat Gan, Israel, May 2019.
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, Condensed Matter Seminar, Hebrew. University, Jerusalem, Israel, May 2019.
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, AMOS Seminar, Weizmann Institute of Science, Rehovot, Israel, May 2019.
- *"Equation Planting: A Tool for Benchmarking Ising Machines*, Lockheed Martin/D-Wave/USC technical exchange meeting, Los Angeles, CA, June 2019.
- *"Paths to supremacy with quantum annealers"*, Cetraro, Italy, June 2019 (invited).
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, Condensed Matter Seminar, University of Napoli, Napoli, Italy, June 2019.
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, Quantum Information Seminar, La Sapienza, Rome, Italy, June 2019.
- *"Quantum annealing with non-stoquastic interactions: Promising paths and likely dead ends"*, AQC 2019- Adiabatic Quantum Computing Conference, Innsbruck, Austria, June 2019.
- *"Can Analog Quantum Computers Solve Classical Spin Glasses?"*, Workshop on Breakdown Of Ergodicity In Isolated Quantum Systems: From Glassiness To Localization, Galileo Galilei Institute for Theoretical Physics, Firenze, Italy, July 2019 (invited).
- *"Equation Planting: A Tool for Benchmarking Ising Machines"*, USC-Fujitsu research kickoff meeting, Los Angeles CA, September 2019.
- *"Simulating quantum many-body physics on classical and quantum computers"*, Nuclear theory seminar, University of Maryland, College Park, MD, October 2019.
- *"The sign problem, non-stoquasticity and everything in between"*, USC Condensed Matter/ Quantum Information seminar, Los Angeles CA, October 2019.
- *"The sign problem, non-stoquasticity and everything in between"*, Quantum Information seminar, NASA Ames Research Center, Moffett Field CA, December 2019.
- *"Non-stoquasticity and quantum annealing"*, QEO YR2 Program Review, Marina del Rey CA, December 2019.
- *"Non-stoquasticity going forward"*, QEO YR2 Program Review, Marina del Rey CA, December 2019.
- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, LBNL Advanced Quantum Testbed Colloquium, Berkeley CA, February 2020.

- *"Future of Analog Quantum Computing: Hopes and Hinderances"*, UCSB Quantum Foundry seminar, Santa Barbara CA, February 2020.
- *"Power of Non-Stoquastic Quantum Annealing Optimization"*, AFRL Program Review, Virtual meeting, April 2020.
- *"Simulating Hamiltonian Dynamics with the Off-diagonal Series Expansion"*, DOE QCAT meeting, Virtual meeting, April 2020 .
- *"Quantum Annealers as Quantum Simulators"*, QEO Milestone Review Meeting, Virtual meeting, June 2020 .
- *"Quantum Algorithms with the Off-diagonal Series Expansion"*, DOE STAQC re-kickoff meeting, Virtual meeting, September 2020.
- *"Simulating Hamiltonian Dynamics with the Off-diagonal Series Expansion"*, Quantum Algorithms 2020, Virtual meeting, September 2020.
- *"An integral-free representation of the Dyson series using divided differences"*, STAQC Applications team meeting (virtual), November 2020.
- *"Quantum algorithm for simulating Hamiltonian dynamics with an off-diagonal series expansion"*, QIP 2021, virtual, February 2021 (poster).
- *"Analog Quantum Computing"*, UC Santa Barbara Winter School on Quantum Science, January 2021.
- *"Simulating Hamiltonian Dynamics with the Off-diagonal Series Expansion"*, Quantum Computing seminar, University of Southern California Virtual meeting, February 2021.
- *"Quantum Algorithm for Simulating Hamiltonian Dynamics with the Off-diagonal Series Expansion"*, APS March Meeting, Virtual, March 2021.
- *"Novel methods for simulating quantum many-body systems on classical and quantum computers"*, ACS Spring 2021, Virtual, April 2021 (poster).
- *"Novel methods for simulating quantum many-body systems on classical and quantum computers"*, ISI's CS&T Monthly meeting, Virtual, April 2021.
- *"TEQUILAS: Towards enhanced quantum annealing in learning and simulation"*, DARPA/DSO Reversible Quantum Machine Learning and Simulation mini kickoff meeting, Virtual, April 2021.
- *"Quantum algorithm for simulating evolution under time-dependent Hamiltonians"*, DOE STAQC bi-weekly meeting, Virtual meeting, May 2021.
- *"Quantum algorithm for simulating evolution under time-dependent Hamiltonians"*, LBNL/UCSB/USC bi-weekly meeting, Virtual meeting, June 2021.
- *"Non-stoquasticity and non-simulability in AQC"*, AQC 2021, Virtual meeting/Japan, June 2021 (invited).
- *"Quantum Algorithm for Simulating Hamiltonian Dynamics with the Off-diagonal Series Expansion"*, IBM Quantum seminar, Virtual, July 2021.
- *"Permutation Matrix Expansion Quantum Monte Carlo"*, XXXII IUPAP Conference on Computational Physics (CCP 2021), Virtual meeting/Coventry, UK, August 2021 (invited).
- *"Simulating topological models with Population Annealing QMC"*, QAFS/QEO telecon, Virtual meeting, August 2021 (invited).
- *"Quantum simulations in the NISQ era: Simulating Hamiltonian dynamics on a quantum computer using the off-diagonal series expansion"*, QEAMS21, Bar-Ilan University, Ramat-Gan Israel, September 2021 (invited).
- *"Analog Quantum Computing"*, IFGW Quantum Technologies School, virtual/Sao Paulo Brazil, October 2021 (invited).
- *"Simulating Hamiltonian dynamics on a quantum computer using the off-diagonal series expansion"*, Quantum Information seminar, George Mason University, virtual, February 2022.

- *"The sign problem, non-stoquasticity and everything in between"*, APS March meeting, virtual, March 2022 (invited).
- *"BeQuEST: Benchmarking Quantum Enhancement for Science & Technology"*, DARPA Quantum Benchmarking meeting, Frisco, TX, March 2022.
- *"Determining QMC simulability with geometric phases"*, SIGN22, Tel Aviv, Israel, September 2022.
- *"BeQuEST: Benchmarking Quantum Enhancement for Science & Technology"*, DARPA Quantum Benchmarking meeting, Arlington, VA, September 2022.
- *"Calculating elements of very large matrix-functions with the off-diagonal series expansion"*, QCAT close-out meeting, Oak Ridge, TN, December 2022.
- *"Calculating functions of extremely large matrices: methods and applications'*, ISI's CS&T Monthly meeting, Marina del Rey/virtual, CA, January 2023.
- *"Mitigating the sign problem with Permutation Matrix Representation quantum Monte Carlo"*, APS March Meeting, Las Vegas, NV, March 2023.
- *"Simulating quantum many-body systems on classical and quantum computers"*, Daniel Lidar's Group Meeting, University of Southern California, Los Angeles, CA, April 2023.
- *"Challenges in evaluating the economic impact of quantum computing funding"*, Economics of Quantum Info Tech conference, University of Southern California, Los Angeles, CA, May 2023 (invited).
- *"Simulating Hamiltonian Dynamics with the Off-diagonal Series Expansion"*, Q-CASA 2023, University of St. Petersburg, FL, May 2023 (invited).
- *"Proposing to and working with DSO"*, ISI's Research Career Development seminar series, Marina del Rey/virtual, CA, June 2023.
- *"Calculating transition amplitudes for time-dependent Hamiltonians"*, SQC Lab group meeting, Technion, Haifa, IL July 2023.
- *"QMC of everything: A universal algorithm for simulating arbitrary quantum many-body systems"*, IPAM Workshop: Many-body Quantum Systems via Classical and Quantum Computation, Los Angeles CA, November 2023 (invited).
- *"QMC of everything: A universal algorithm for simulating arbitrary quantum many-body systems"*, ECE Seminar at USC,, Los Angeles CA, November 2023.
- *"A Monte Carlo algorithm for calculating the overlap between ground states"*, APS March Meeting 2024, Minneapolis, MN, March 2024.
- *"New phases of matter from quantum simulations of periodically driven systems"*, IMPAQT performer meeting, Virtual, March 2024.
- *"Optimal quantum simulations of Hamiltonians with symmetries"*, ISQED 2024, San Francisco, CA, April 2024 (invited, scheduled).