

# Hsin-Yuan Huang (Robert)

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## POSITIONS

### California Institute of Technology

*Assistant Professor of Theoretical Physics; William H. Hurt Scholar* 2025 - Present

### Google Quantum AI

*Staff Research Scientist* 2025 - Present  
*Senior Research Scientist* 2023 - 2025

### Stanford University

*Visiting Faculty* 2025

### MIT Center for Theoretical Physics

*Visiting Scientist* 2023 - 2024

### Simons Institute for the Theory of Computing, UC Berkeley

*Visiting Scientist* 2024

## EDUCATION

### Ph.D., California Institute of Technology

2018 - 2024

Advisors: John Preskill (Physics) and Thomas Vidick (Computer Science)

Member, Institute for Quantum Information and Matter (IQIM)

Dissertation: *Learning in the Quantum Universe*

Recipient of the *Milton and Francis Clauser Doctoral Prize*, 2024

(Awarded annually to a single dissertation exhibiting the highest originality among all graduates)

### B.S., National Taiwan University

2014 - 2018

Major: *Computer Science*, Minor: *Physics*. GPA: 4.30 / 4.30, Class Rank: 1 / 120

Member, Machine Learning and Data Mining Group; Advisor: Chih-Jen Lin

## RESEARCH EXPERIENCE

### Simons Institute for the Theory of Computing, UC Berkeley

Visiting Student (Host: Umesh Vazirani) 2022

### AWS Center for Quantum Computing

Research Intern (Mentor: Steven T. Flammia) 2021

### Google Quantum AI

Research Intern (Mentor: Jarrod R. McClean) 2020

### Centre for Quantum Technologies, NUS

Visiting Student (Host: Patrick Rebentrost) 2019

### Allen Institute for Artificial Intelligence

Research Intern (Mentor: Scott Wen-tau Yih) 2018

### Microsoft Research

Research Intern (Mentor: Chenguang Zhu) 2017

## HONORS AND AWARDS

### Endowed Early Career Professorship

*William H. Hurt Scholar, California Institute of Technology* 2025

### Research Awards

*Frontiers of Science Award in Condensed Matter Physics,* 2025

“Predicting Many Properties of a Quantum System from Very Few Measurements”

*Broadcom Innovation Fund* 2024

### Graduate Fellowships and Awards

*American Physical Society DQI Best Thesis Award* 2025

*Milton and Francis Clauser Doctoral Prize* 2024

(Awarded to a single Caltech Ph.D. graduate whose thesis exhibits the highest originality)

*Ben P. C. Chou Doctoral Prize in Information Science and Technology* 2024

*Google Ph.D. Fellowship* 2021 - 2023

*Boeing Quantum Creators Prize* 2021

*Kortschak Scholars Fellowship* 2018 - 2020

### Plenary and Honorary Talks

*Invited Tutorial, Quantum Information Processing (QIP)* 2025

“Quantum Learning and Certification”

*Long Plenary Talk, Quantum Information Processing (QIP)* 2025

“Random Unitaries in Extremely Low Depth”

*Short Plenary Talk, Quantum Information Processing (QIP)* 2025

“How to Construct Random Unitaries”

*Keynote Speech, Future Science Prize Symposium* 2024

“Learning in the Quantum Universe”

*Short Plenary Talk, Quantum Information Processing (QIP)* 2024

“Learning Shallow Quantum Circuits”

*Short Plenary Talk, Quantum Information Processing (QIP)* 2023

“Learning Many-Body Hamiltonians with Heisenberg-Limited Scaling”

*Long Plenary Talk, Quantum Information Processing (QIP)* 2022

“Provably Efficient Machine Learning for Quantum Many-Body Problems”

*Short Plenary Talk, Quantum Information Processing (QIP)* 2020

“Predicting Features of Quantum Systems using Classical Shadows”

### Academic Excellence Awards

*First Place Scholarship, Taiwan* 2015, 2016, 2017, 2018

(Awarded to Olympiad medalists ranking #1)

*Presidential Award, Taiwan* Fall/Spring 2015, 2016, 2017, 2018

(Awarded to students ranking in the top 5%)

## ADDITIONAL HONORS AND AWARDS

Quantum Innovator in Computer Science and Mathematics 2022

MediaTek Research Young Scholarship 2021

J. Yang Scholarship	2020 - 2021
Taiwan Government Scholarship to Study Abroad	2019
The Phi Tau Phi Scholastic Honor Society of the Republic of China	2018
Undergraduate Research Project Exhibition, First Place	2017
Appier Scholarship	2016, 2017
AAAI Conference on Artificial Intelligence Scholarship	2017
Shih-Liang Chien Memorial Award	2016
SIAM International Conference on Data Mining Travel Award	2016
Wang Da Gang Natural Science Scholarship	2013
International Olympiad in Informatics, Bronze Medal	2013
Asia-Pacific Informatics Olympiad, Silver Medal	2013
National Informatics Olympiad in Taiwan, First Place	2012
Taiwan International Science Fair, Third Prize	2012
Science Research Grant for High School Students, First Prize	2012
Taipei High School Informatics Competition, First Place	2012

## PROFESSIONAL ACTIVITIES

### Journal Reviewer

Nature, Nature Physics, Proceedings of the National Academy of Sciences (PNAS), Science Advances, Nature Communications, Nature Computational Science, Communications Physics, Physical Review X, Physical Review Letters, PRX Quantum, IEEE Transactions on Information Theory, Journal of Machine Learning Research, npj Quantum Information, npj Quantum Materials, Quantum, ACM Transactions on Quantum Computing, Physical Review Research, Physical Review A, Quantum Machine Intelligence, Data Mining and Knowledge Discovery.

### Conference Reviewer

Quantum Information Processing (QIP), Theory of Quantum Computation (TQC), ACM Symposium on Theory of Computing (STOC), IEEE Symposium on Foundations of Computer Science (FOCS), ACM-SIAM Symposium on Discrete Algorithms (SODA), Innovations in Theoretical Computer Science (ITCS), Conference on Neural Information Processing Systems (NeurIPS), International Conference on Machine Learning (ICML), International Conference on Learning Representations (ICLR).

### Program Committee

Subject Chair: QIP 2026  
Member: QIP 2024, TQC 2023

### Grant Review Committee

Google Academic Research Awards (Quantum Transduction and Networking for Scalable Computing Applications), US-Israel Binational Science Foundation

### Prize Review Committee

XPRIZE Quantum Applications (\$5 Million)

### Fellowship Review Committee

Google PhD Fellowship in Quantum Computing (2024)

### Workshop Organization

Recent Advances in Quantum Learning at FOCS 2024

### Invited Panel Participation

Quantum Colloquium (April 15, 2025)

**Conference Service**

QIP 2022, AAAI 2017

**PUBLICATIONS (ALL ARTICLES REFEREED)**

- [1] Z.-H. Liu, R. Brunel, E. E. B. Østergaard, O. Cordero, S. Chen, Y. Wong, J. A. H. Nielsen, A. B. Bregnsbo, S. Zhou, **H.-Y. Huang**, C. Oh, L. Jiang, J. Preskill, J. S. Neergaard-Nielsen, U. L. Andersen. Quantum learning advantage on a scalable photonic platform. *Science* (2025).
- [2] **(alphabetical order) H.-Y. Huang**, J. Preskill, M. Soleimanifar. Certifying almost all quantum states with few single-qubit measurements. *Nature Physics* (2025). In *65th Annual IEEE Symposium on Foundations of Computer Science (FOCS-24)*, 2024. In *27th Annual Conference on Quantum Information Processing (QIP-24)*, 2024. (Contributed talk)
- [3] T. Schuster, J. Haferkamp, **H.-Y. Huang**. Random unitaries in extremely low depth. *Science* 389, 92-96 (2025). In *28th Annual Conference on Quantum Information Processing (QIP-25)*, 2025. (Long plenary talk)
- [4] K. V. Kirk, J. Cotler, **H.-Y. Huang**, M. D. Lukin. Hardware-efficient learning of quantum many-body states. *Physical Review Letters* (2025).
- [5] F. Vasconcelos, **H.-Y. Huang**. Learning shallow quantum circuits with many-qubit gates. In *38th Annual Conference on Learning Theory (COLT-25)*, 2025.
- [6] **(alphabetical order) S. Chen**, J. D. Pont, J.-T. Hsieh, **H.-Y. Huang**, J. Lange, J. Li. Predicting quantum channels over general product distributions. In *38th Annual Conference on Learning Theory (COLT-25)*, 2025.
- [7] A. Angrisani, A. Schmidhuber, M. S. Rudolph, M. Cerezo, Z. Holmes, **H.-Y. Huang**. Classically estimating observables of noiseless quantum circuits. In *20th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC-25)*, 2025. (Contributed talk)
- [8] **(alphabetical order) C.-F. Chen**, **H.-Y. Huang**, J. Preskill, L. Zhou. Local minima in quantum systems. *Nature Physics*, 2025. In *56th Annual ACM Symposium on Theory of Computing (STOC-24)*, 2024. In *27th Annual Conference on Quantum Information Processing (QIP-24)*, 2024. (Contributed talk)
- [9] F. Ma, **H.-Y. Huang**. How to construct random unitaries. In *57th Annual ACM Symposium on Theory of Computing (STOC-25)*, 2025. In *28th Annual Conference on Quantum Information Processing (QIP-25)*, 2025. (Short plenary talk) Invited to *SICOMP Special Issue*.
- [10] **(alphabetical order) Google Quantum AI and Collaborators**. Quantum error correction below the surface code threshold. *Nature*, 2024.
- [11] C. Oh, S. Chen, Y. Wong, S. Zhou, **H.-Y. Huang**, J. A.H. Nielsen, Z.-H. Liu, J. S. Neergaard-Nielsen, U. L. Andersen, L. Jiang, J. Preskill. Entanglement-enabled advantage for learning a bosonic random displacement channel. *Phys. Rev. Lett.* 133, 230604, 2025.
- [12] H. Zhao, L. Lewis, I. Kannan, Y. Quek, **H.-Y. Huang**, M. C. Caro. Learning quantum states and unitaries of bounded gate complexity. *PRX Quantum* 5, 040306, 2024.
- [13] **H.-Y. Huang<sup>†</sup> (co-first author)**, Y. Liu<sup>†</sup>, M. Broughton, I. Kim, A. Anshu, Z. Landau, J. R. McClean. Learning shallow quantum circuits. In *56th Annual ACM Symposium on Theory of Computing (STOC-24)*, 2024. In *27th Annual Conference on Quantum Information Processing (QIP-24)*, 2024. (Short plenary talk) Invited to *SICOMP Special Issue*.
- [14] S. Chen, C. Oh, S. Zhou, **H.-Y. Huang**, L. Jiang. Tight bounds on Pauli channel learning without entanglement. *Phys. Rev. Lett.* 132, 180805, 2024.
- [15] J. Gibbs, Z. Holmes, M. C. Caro, N. Ezzell, **H.-Y. Huang**, L. Cincio, A. T. Sornborger, P. J. Coles. Dynamical simulation via quantum machine learning with provable generalization. *Phys. Rev. Research* 6, 013241 (2024).

- [16] Y. Zhan, A. Elben, **H.-Y. Huang**, Y. Tong. Learning conservation laws in unknown quantum dynamics. *PRX Quantum* 5, 010350 (2024).
- [17] L. Lewis, **H.-Y. Huang**, V. Tran, S. Lehner, R. Kueng, J. Preskill. Improved machine learning algorithms for predicting ground state properties. *Nature Communications*, 15, 895, 2024. In *26th Annual Conference on Quantum Information Processing (QIP-23)*, 2023. (Contributed talk)
- [18] **H.-Y. Huang**, S. Chen, J. Preskill. Learning to predict arbitrary quantum processes. *PRX Quantum* 4, 040337 (2023). In *26th Annual Conference on Quantum Information Processing (QIP-23)*, 2023. (Contributed talk)
- [19] A. Abbas, R. King, **H.-Y. Huang**, W. J. Huggins, R. Movassagh, D. Gilboa, J. R. McClean. On quantum backpropagation, information reuse, and cheating measurement collapse. In *37th Conference on Neural Information Processing Systems (NeurIPS)*, 2023. (Spotlight)
- [20] **H.-Y. Huang**<sup>†</sup> (co-first author), Y. Tong<sup>†</sup>, D. Fang, Y. Su. Learning many-body Hamiltonians with Heisenberg-limited scaling. *Physical Review Letters* 130, 200403 (2023). In *26th Annual Conference on Quantum Information Processing (QIP-23)*, 2023. (Short plenary talk)
- [21] M. C. Caro<sup>†</sup>, **H.-Y. Huang**<sup>†</sup> (co-first author), N. Ezzell, J. Gibbs, A. T. Sornborger, L. Cincio, P. J. Coles, Z. Holmes. Out-of-distribution generalization for learning quantum dynamics. *Nature Communications* 14.1 (2023): 3751.
- [22] J. Choi, A. Shaw, I. Madjarov, X. Xie, J. Covey, J. Cotler, D. Mark, **H.-Y. Huang**, A. Kale, H. Pichler, F. Brandao, S. Choi, M. Endres. Preparing random states and benchmarking with many-body quantum chaos. *Nature* 613 (2023): 468-473.
- [23] J. Cotler<sup>†</sup>, D. Mark<sup>†</sup>, **H.-Y. Huang**<sup>†</sup> (co-first author), F. Hernandez, J. Choi, A. L. Shaw, M. Endres, S. Choi. Emergent quantum state designs from individual many-body wavefunctions. *PRX Quantum* 4, 010311 (2023).
- [24] (alphabetical order) A. Elben, S. Flammia, **H.-Y. Huang**, R. Kueng, J. Preskill, B. Vermersch, P. Zoller. The randomized measurement toolbox. *Nature Review Physics*, 2022.
- [25] (alphabetical order) S. Chen, J. Cotler, **H.-Y. Huang**, J. Li. The complexity of NISQ. *Nature Communications* 14, 6001 (2023). In *26th Annual Conference on Quantum Information Processing (QIP-23)*, 2023. (Contributed talk)
- [26] **H.-Y. Huang**, R. Kueng, G. Torlai, V. V. Albert, J. Preskill. Provably efficient machine learning for quantum many-body problems. *Science* 377.6613 (2022). In *25th Annual Conference on Quantum Information Processing (QIP-22)*, 2022. (Plenary talk)
- [27] M. Cerezo, G. Verdon, **H.Y. Huang**, L. Cincio, P. Coles. Challenges and opportunities in quantum machine learning. *Nature Computational Science* 2 (2022): pp. 567-576.
- [28] M. C. Caro, **H.-Y. Huang**, M. Cerezo, K. Sharma, A. Sornborger, L. Cincio, P. J. Coles. Generalization in quantum machine learning from few training data. *Nature Communications* 13.1 (2022): pp. 1-11.
- [29] **H.-Y. Huang**, M. Broughton, J. Cotler, S. Chen, J. Li, M. Mohseni, H. Neven, R. Babbush, R. Kueng, J. Preskill, J. R. McClean. Quantum advantage in learning from experiments. *Science* 376.6598 (2022): pp. 1154-1155.
- [30] **H.-Y. Huang**, S. Flammia, J. Preskill. Foundations for learning from noisy quantum experiments. In *25th Annual Conference on Quantum Information Processing (QIP-22)*, 2022. (Contributed talk)
- [31] **H.-Y. Huang**, Learning quantum states from their classical shadows. *Nature Review Physics* 4.2 (2022): pp. 81-81.

- [32] **(alphabetical order)** S. Chen, J. Cotler, **H.-Y. Huang**, J. Li. Exponential separation between learning with and without quantum memory. In *62nd Annual IEEE Symposium on Foundations of Computer Science (FOCS-21)*, 2021. Invited to *SICOMP Special Issue*.
- [33] J. R. McClean, N. C. Rubin, J. Lee, M. P. Harrigan, T. E. O'Brien, R. Babbush, W. J. Huggins, **H.-Y. Huang**. What the foundations of quantum computer science teach us about chemistry. *Journal of Chemical Physics* 155.15 (2021): 150901.
- [34] **H.-Y. Huang**, R. Kueng, J. Preskill. Efficient estimation of Pauli observables by derandomization. *Physical Review Letters* 127.3 (2021): 030503.
- [35] **H.-Y. Huang**, R. Kueng, J. Preskill. Information-theoretic bounds on quantum advantage in machine learning. *Physical Review Letters (Editor's Suggestion)* 126.19 (2021): 190505. In *24th Annual Conference on Quantum Information Processing (QIP-21)*, 2021 (Talk title: Fundamental aspects of solving quantum problems with machine learning).
- [36] Y. Su, **H.-Y. Huang**, E. Campbell. Nearly-tight Trotterization of interacting electrons. *Quantum* 5 (2021): 495. In *24th Annual Conference on Quantum Information Processing (QIP-21)*, 2021. (Contributed talk)
- [37] **H.-Y. Huang**, M. Broughton, M. Mohseni, R. Babbush, S. Boixo, H. Neven, J. R. McClean. Power of data in quantum machine learning. *Nature Communications* 12.1 (2021): 1-9. In *24th Annual Conference on Quantum Information Processing (QIP-21)*, 2021 (Talk title: Fundamental aspects of solving quantum problems with machine learning).
- [38] C.-F. Chen<sup>†</sup>, **H.-Y. Huang<sup>†</sup> (co-first author)**, R. Kueng, J. Tropp. Concentration for random product formulas. *PRX Quantum* 2.4 (2021): 040305.
- [39] **H.-Y. Huang**, K. Bharti, P. Rebentrost. Near-term quantum algorithms for linear systems of equations with regression loss functions. *New Journal of Physics* 23.11 (2021): 113021.
- [40] A. Elben, R. Kueng, **H.-Y. Huang**, R. van Bijnen, C. Kokail, M. Dalmonte, P. Calabrese, B. Kraus, J. Preskill, P. Zoller, B. Vermersch. Mixed-state entanglement from local randomized measurements. *Physical Review Letters* 125.20 (2020): 200501.
- [41] **H.-Y. Huang**, R. Kueng, J. Preskill. Predicting many properties in a quantum system from very few measurements. *Nature Physics* 16.10 (2020): 1050-1057. In *23rd Annual Conference on Quantum Information Processing (QIP-20)*, 2020. (Short plenary talk)
- [42] **H.-Y. Huang**, E. Choi, W. Yih. FlowQA: grasping flow in history for conversational machine comprehension. In *7th International Conference on Learning Representations (ICLR-19)*, 2019.
- [43] **H.-Y. Huang**, C. Zhu, Y. Shen, W. Chen. FusionNet: Fusing via Fully-aware attention with application to machine comprehension. In *6th International Conference on Learning Representations (ICLR-18)*, 2018. (top 3% in review score)
- [44] H.-F. Yu, **H.-Y. Huang**, I. S. Dhillon, C.-J. Lin. A unified algorithm for one-class structured matrix factorization with side information. In *31st AAAI Conference on Artificial Intelligence (AAAI-17)*, 2017. (acceptance rate: 24.6%)
- [45] **H.-Y. Huang**, C.-J. Lin. Linear and kernel classification: When to use which? In *SIAM International Conference on Data Mining (SDM-16)*, 2016. (acceptance rate: 25.8%)
- [46] C.-Y. Chen, A. Ho, **H.-Y. Huang**, H.-F. Juan and H.-C. Huang. Dissecting the human protein-protein interaction network via phylogenetic decomposition. In *Scientific Reports* 4.1 (2014): 1-10.

## PREPRINTS

- [1] **H.-Y. Huang**, M. Broughton, N. Eassa, H. Neven, R. Babbush, J. R. McClean. Generative quantum advantage for classical and quantum problems. arXiv preprint, arXiv:2509.09033, 2025.
- [2] **H.-Y. Huang**, S. Choi, J. R. McClean, J. Preskill. The vast world of quantum advantage. arXiv preprint, arXiv:2508.05720, 2025.
- [3] L. Cui, T. Schuster, F. Brandao, **H.-Y. Huang**. Unitary designs in nearly optimal depth. arXiv preprint, arXiv:2507.06216, 2025.
- [4] **(alphabetical order)** Google Quantum AI and Collaborators. Constructive interference at the edge of quantum ergodic dynamics. arXiv preprint, arXiv:2506.10191, 2025.
- [5] R. R. Allen, F. Machado, I. L. Chuang, **H.-Y. Huang**, S. Choi. Quantum Computing Enhanced Sensing. arXiv preprint, arXiv:2501.07625, 2025.
- [6] Z. Zimborás, B. Koczor, Z. Holmes, E.-M. Borrelli, A. Gilyén, **H.-Y. Huang**, Z. Cai, A. Acín, L. Aolita, L. Banchi, F. G. S. L. Brandão, D. Cavalcanti, T. Cubitt, S. N. Filippov, G. García-Pérez, J. Gool, O. Kálmán, E. Kyoseva, M. A.C. Rossi, B. Sokolov, I. Tavernelli, S. Maniscalco. Myths around quantum computation before full fault tolerance: What no-go theorems rule out and what they don't. arXiv preprint, arXiv:2501.05694, 2025.
- [7] J. Huang, L. Lewis, **H.-Y. Huang**, J. Preskill. Predicting adaptively chosen observables in quantum systems. arXiv preprint, arXiv:2410.15501, 2024.
- [8] S. Jerbi, J. Gibbs, M. S. Rudolph, M. C. Caro, P. J. Coles, **H.-Y. Huang**, Z. Holmes. The power and limitations of learning quantum dynamics incoherently. arXiv preprint, arXiv:2303.12834, 2023.
- [9] **(alphabetical order)** J. Cotler, **H.-Y. Huang**, J. R. McClean. Revisiting dequantization and quantum advantage in learning tasks. arXiv preprint, arXiv:2112.00811, 2021.
- [10] **(alphabetical order)** S. Chen, J. Cotler, **H.-Y. Huang**, J. Li. A hierarchy for replica quantum advantage. arXiv preprint, arXiv:2111.05874, 2021.
- [11] M. Broughton, G. Verdon, T. McCourt, A. J. Martinez, J. H. Yoo, S. V. Isakov, P. Massey, R. Halavati, M. Y. Niu, A. Zlokapa, E. Peters, O. Lockwood, A. Skolik, S. Jerbi, V. Dunjko, M. Leib, M. Streif, D. V. Dollen, H. Chen, S. Cao, R. Wiersema, **H.-Y. Huang**, J. R. McClean, R. Babbush, S. Boixo, D. Bacon, A. K. Ho, H. Neven, M. Mohseni. TensorFlow Quantum: A Software Framework for Quantum Machine Learning. arXiv preprint, arXiv:2003.02989, 2020.

## TEACHING EXPERIENCE

Guest lecture on “Predicting properties in quantum systems” for the course “Quantum computation and quantum complexity” at Harvard University (2022).

Guest lecture on “Learning quantum states” for the course “Quantum algorithms and programming” at Caltech (2021).

Lecture on “Online learning” for the course “Advanced algorithms” at Caltech (2020).

Teaching Assistant: Introduction to the Theory of Computation (2017).

## TALKS

- [1] “Generative quantum advantage”. Invited talk at Quantum Spain Seminar, Oct. 7th, 2025.
- [2] “What cannot be learned in the quantum universe”. Invited talk at EPFL, Sep. 4nd, 2025.

- [3] "Quantum advantage in learning and sensing". Invited talk at Technical University of Munich, Sep. 2nd, 2025.
- [4] "Generative quantum advantage". Invited talk at National Taiwan University, Aug. 27th, 2025.
- [5] "Generative quantum advantage". Plenary talk at The Institute for Artificial Intelligence and Fundamental Interactions (IAIFI), Aug. 15th, 2025.
- [6] "Quantum advantage in learning and sensing". Invited Talk at Institute of Biomedical Electronics and Bioinformatics, National Taiwan University, Jul. 15th, 2025.
- [7] "Quantum advantage in learning and sensing". Invited Talk at Centre for Quantum Technologies, National University of Singapore, Jul. 10th, 2025.
- [8] "The vast world of quantum advantage". Plenary talk at AI4X, Jul. 9th, 2025.
- [9] "What cannot be learned in the quantum universe". Invited talk at QuARC, ICCS 2025, Jul. 8th, 2025.
- [10] "Generative quantum advantage". Contributed talk at Quantum Computer Science Meeting, Google Quantum AI, Jun. 24th, 2025.
- [11] "Certifying quantum states with few single-qubit measurements". Invited Talk at Korea Institute for Advanced Study (KIAS) workshop on Quantum Information Dynamics, Jun. 23rd, 2025.
- [12] "Learning shallow quantum circuits". Invited Talk at MIT quantum information science and engineering (iQuISE) seminar, May. 15th 2025.
- [13] "New directions in the theory of quantum AI". Contributed talk at Quantum Algorithm Meeting, Google Quantum AI, May. 14th, 2025.
- [14] "Random unitaries". Short Talk on Quantum Information Physics, IQIM NSF Review, Apr. 14th, 2025.
- [15] "Quantum advantage in learning and sensing". Invited Seminar at MIT-Harvard Center for Ultracold Atoms, Apr. 1st, 2025.
- [16] "Quantum computing enhanced sensing". Invited Talk at AI for Good Webinar, Mar. 27th, 2025.
- [17] "Quantum computing enhanced sensing". Invited Talk at Choi Group, Stanford University, Mar. 26th, 2025.
- [18] "What cannot be learned in the quantum universe". Invited talk at Facets of Entanglement, Princeton Center for Theoretical Science, Mar. 24th, 2025.
- [19] "Learning in the quantum universe". Invited talk at APS Global Physics Summit, Mar. 17th, 2025.
- [20] "Quantum advantage in learning and sensing". Invited Talk, Stanford University, Mar. 5th, 2025.
- [21] "What cannot be learned in the quantum universe". Invited Talk, University of Minnesota, Feb. 25th, 2025.
- [22] "Quantum Learning and Certification". Invited Tutorial, 28th Annual Conference on Quantum Information Processing (QIP-25), Feb. 22nd, 2025.
- [23] "What quantum AI can't learn". Invited Talk at AI+Quantum, Aspen Center for Physics, Feb. 13th, 2025.
- [24] "Quantum computing enhanced sensing". Invited Talk at the Department of Electrical Engineering, National Taiwan University, Dec. 23rd, 2024.
- [25] "Quantum computing enhanced sensing". Invited Talk at the Frontiers of Quantum information and Computation, Banff International Research Station for Mathematical Innovation and Discovery, Dec. 13th, 2024.
- [26] "Learning in the quantum universe". Invited talk at New York University, Dec. 10th, 2024.
- [27] "Tutorial on learning theory". Invited tutorial at Frontiers of Quantum information and Computation, Banff International Research Station for Mathematical Innovation and Discovery, Dec. 10th, 2024.



- [28] "What cannot be learned in the quantum universe". Invited Talk at String/Gravity Seminar, Massachusetts Institute of Technology, Dec. 4th, 2024.
- [29] "What quantum AI can't learn". Invited Talk at Quantum Computer Science Seminar, Google Quantum AI, Dec. 3rd, 2024.
- [30] "Random unitaries in extremely low depth". Invited Talk at Quantum Colloquium, Simons Institute for the Theory of Computing, Nov. 19th, 2024.
- [31] "Quantum computing enhanced sensing". Contributed talk at Quantum Algorithm Meeting, Google Quantum AI, Nov. 13th, 2024.
- [32] "Quantum computing enhanced sensing". Invited Talk at Phasecraft Research Workshop, Nov. 12th, 2024.
- [33] "Certifying almost all quantum states with few single-qubit measurements". Invited Talk at Phasecraft. Nov. 11th, 2024.
- [34] "Learning in the quantum universe". Keynote Speech at the Future Science Prize Symposium, Nov. 3rd, 2024.
- [35] "Learning in the quantum universe". Invited Talk at the VII Quantum Computing Workshop at UFSC, Oct. 29th, 2024.
- [36] "Past, present, and future of learning in the quantum universe". Invited Science Talk at Caltech IQIM Retreat, Oct. 27th, 2024.
- [37] "Random unitaries in extremely low depth". Invited Talk at Stanford University, Oct. 25th, 2024.
- [38] "Local minima in quantum systems". Invited talk at the workshop on Mathematical Challenges of Quantum Algorithms for Open Quantum Systems, Oct. 23th, 2024.
- [39] "Recent advances in quantum machine learning". Contributed talk at Google Quantum Annual Meeting QML Seminar, Oct. 21st, 2024.
- [40] "What cannot be learned in the quantum universe?". Invited Talk at IQuS research seminar, Oct. 16th, 2024.
- [41] "Certifying almost all quantum states with few single-qubit measurements". Invited Talk at Los Alamos National Laboratory. Oct. 8th, 2024.
- [42] "Certifying almost all quantum states with few single-qubit measurements". Invited Talk at Assessing Performance of Quantum Computers (APQC) 2024. Oct. 8th, 2024.
- [43] "What cannot be learned in the quantum universe?". Invited Talk at CIFAR Quantum Information Science (QIS) program meeting, Sep. 27th, 2024.
- [44] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at IBM Qiskit Quantum Seminar, Aug. 30th, 2024.
- [45] "Shallow quantum circuits". Invited lecture at Institute for Advanced Study, Aug. 28th, 2024.
- [46] "Certifying almost all quantum states with few single-qubit measurements". Invited group meeting talk at UMD Nuclear Physics, Aug. 27th, 2024.
- [47] "Learning shallow quantum circuits". Invited Talk at QSim 2024, Aug. 13th 2024.
- [48] "Learning & Quantum Simulations: Part II". Invited Lecture at RQS Summer School 2024, Aug. 11th 2024.
- [49] "Learning & Quantum Simulations: Part I". Invited Lecture at RQS Summer School 2024, Aug. 11th 2024.
- [50] "Pseudorandom unitaries". Invited Talk at Academia Sinica, Aug. 7th, 2024.
- [51] "Random unitaries in extremely low depth". Invited Talk at National Taiwan University, Aug. 2nd, 2024.
- [52] "Learning in the quantum universe". MIT-Harvard Chilloquium, Jul. 31st, 2024.

- [53] "Quantum advantage". Invited Talk at National Taiwan University, Jul. 22nd, 2024.
- [54] "Learning in the quantum universe II: Provable quantum advantage". Invited Lecture at QIST Faculty Workshop on Quantum Machine Learning, Jun. 28th, 2024.
- [55] "Learning in the quantum universe I: Power of data in quantum machine learning". Invited Lecture at QIST Faculty Workshop on Quantum Machine Learning, Jun. 28th, 2024.
- [56] "Learning shallow quantum circuits". Contributed talk at the 56th Symposium on Theory of Computing (STOC-24), Jun. 27th, 2024.
- [57] "Learning shallow quantum circuits". Invited Lecture at Los Alamos Quantum Computing Summer School, Jun. 21st, 2024.
- [58] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at Quantum Photonics, Clubhouse, Jun. 17th, 2024.
- [59] "Learning shallow quantum circuits". Invited talk at Google Quantum Summer Symposium, Jun. 6th, 2024.
- [60] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at Physics of Quantum Information, Perimeter Institute for Theoretical Physics, May. 29th, 2024.
- [61] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at Quantinuum, May. 7th, 2024.
- [62] "Inverse-resistant pseudorandom unitaries". Contributed talk at the Pseudorandom Unitary Workshop at the Simons Institute for the Theory of Computing, May. 6th, 2024.
- [63] "Shallow random unitaries". Contributed talk at the Pseudorandom Unitary Workshop at the Simons Institute for the Theory of Computing, May. 6th, 2024.
- [64] "Learning shallow quantum circuits". Invited talk at ML & Math Seminar, Caltech, Apr. 30th, 2024.
- [65] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at the Simons Institute for the Theory of Computing, Apr. 24th, 2024.
- [66] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at the Quantum Now Workshop, Finland, Apr. 3rd, 2024.
- [67] "Certifying almost all quantum states with few single-qubit measurements". Invited talk at the Math Picture Language Seminar at Harvard University, Mar. 26th, 2024.
- [68] "Local minima in quantum systems". Invited talk at the Simons Institute for the Theory of Computing, Mar. 18th, 2024.
- [69] "Certifying highly-entangled states with few single-qubit measurements". Invited talk at APS March Meeting, Mar. 4th, 2024.
- [70] "Local minima in quantum systems", Invited talk at the Institute of Atomic and Molecular Sciences, Academia Sinica, Jan. 30th, 2024.
- [71] "Learning shallow quantum circuits". Short plenary talk, 27th Annual Conference on Quantum Information Processing (QIP-24), Jan. 19th, 2024.
- [72] "Certifying highly-entangled states with few single-qubit measurements". Contributed talk, 27th Annual Conference on Quantum Information Processing (QIP-24), Jan. 18th, 2024.
- [73] "Complexity of learning and creating quantum systems", Invited talk at the Workshop on Spacetime and Quantum Information, Institute for Advanced Study (IAS), Dec. 12th, 2023.
- [74] "Local minima in quantum systems", Invited talk at Princeton University, Dec. 7th, 2023.

- [75] "Provably efficient machine learning for quantum many-body problems", Invited talk at Harvard Condensed Matter Theory Kid's Seminar, Dec. 5th, 2023.
- [76] "Learning theory for quantum machines", Tutorial talk at Quantum Techniques in Machine Learning (QTML) at CERN, Nov. 19th, 2023.
- [77] "Local minima in quantum systems", Invited talk at the High Energy Theory Seminar at Northeastern University, Nov. 7th, 2023.
- [78] "Local minima in quantum systems", Invited talk at the Long Table Physics Seminar, Harvard University, Nov. 4th, 2023.
- [79] "The complexity of NISQ", Invited talk at the Theory of Computing Seminar, Harvard University, Nov. 1st, 2023.
- [80] "Local minima in quantum systems", Invited talk at the UC San Diego, Oct. 25th, 2023.
- [81] "Learning in the quantum universe". Invited Talk at the Harvard Undergraduate Quantum Computing Association, Oct. 18th, 2023.
- [82] "Learning to predict arbitrary quantum processes", Invited talk, Workshop on Mathematical Aspects of Quantum Learning, Institute for Pure & Applied Mathematics, UCLA, Sep. 16th, 2023.
- [83] "Local minima in quantum systems", Invited talk at MIT, Sep. 27th, 2023.
- [84] "Local minima in quantum systems", Contributed talk at Quantum Algorithm Meeting, Google Quantum AI, Sep. 21st, 2023.
- [85] "Learning shallow quantum circuits", Invited talk at Sitan Chen's group seminar, Harvard University, Sep. 21st, 2023.
- [86] "Learning theory in the quantum universe Part II", Invited tutorial, Mathematical and Computational Challenges in Quantum Computing, IPAM, UCLA, Sep. 16th, 2023.
- [87] "Learning theory in the quantum universe Part I", Invited tutorial, Mathematical and Computational Challenges in Quantum Computing, IPAM, UCLA, Sep. 16th, 2023.
- [88] "The Complexity of NISQ", Invited talk, Frontiers of near-term quantum computing, Gothenburg, Sweden, Aug. 29th, 2023.
- [89] "Proving quantum advantage in learning from experiments (Part II)". Invited lecture, QMATH Masterclass on quantum learning theory, Copenhagen, Aug. 25th, 2023.
- [90] "Proving quantum advantage in learning from experiments (Part I)". Invited lecture, QMATH Masterclass on quantum learning theory, Copenhagen, Aug. 24th, 2023.
- [91] "Learning many-body Hamiltonians with Heisenberg-limited scaling". Invited talk, International Workshop on Quantum Characterization, Verification and Validation, Shanghai, Aug. 22nd, 2023.
- [92] "Learning to predict arbitrary quantum processes". Invited talk, QML Seminar, Centre for Quantum Technologies, Jul. 3rd, 2023.
- [93] "Learning in the quantum universe". Invited Talk at the Electrical Engineering Department at Stanford University, Apr. 2nd, 2023.
- [94] "Learning in the quantum universe". Invited Talk at Department of Mathematics and the Stephen A. Schwarzman College of Computing, Massachusetts Institute of Technology, Mar. 9th, 2023.
- [95] "Learning in the quantum universe". Invited Talk at the Applied Physics Department at Stanford University, Mar. 1st, 2023.

- [96] "Learning in the quantum universe". Invited Talk at Princeton University, Feb. 22nd, 2023.
- [97] "Learning in the quantum universe". Invited Talk at Yale University, Feb. 14nd, 2023.
- [98] "Learning many-body Hamiltonians with Heisenberg-limited scaling". Short plenary talk, 26th Annual Conference on Quantum Information Processing (QIP-23), Feb. 8th, 2023.
- [99] "Learning to predict arbitrary quantum processes". Contributed talk, 26th Annual Conference on Quantum Information Processing (QIP-23), Feb. 6th, 2023.
- [100] "Learning to predict arbitrary quantum processes". Invited Talk at Perimeter Institute, Feb. 2nd, 2023.
- [101] "Learning in the quantum universe". Colloquium Talk at UC Berkeley, Jan. 24th, 2023.
- [102] "Learning in the quantum universe". Invited Talk at Nanjing University, Dec. 27th, 2022.
- [103] "Quantum advantage in learning from experiments". Invited Talk at Carnegie Mellon University hosted by Ryan O'Donnell, Dec. 9th, 2022.
- [104] "Learning in the quantum universe". Colloquium Talk at the Pritzker School of Molecular Engineering, University of Chicago, Dec. 6th, 2022.
- [105] "Learning to predict arbitrary quantum processes". Invited Talk at the University of Texas at Austin, Dec. 1st, 2022.
- [106] "Provably efficient machine learning for quantum many-body problems". Invited Talk at CompQu Seminar Series, Taiwan National Center for Theoretical Sciences, Nov. 29th, 2022.
- [107] "The complexity of NISQ". Invited Talk at the University of Texas at Austin, Nov. 28th, 2022.
- [108] "Advanced protocols for extracting properties from quantum systems". Invited Talk at Perimeter Institute, Nov. 24th, 2022.
- [109] "Learning in the quantum universe". Colloquium Talk at Perimeter Institute, Nov. 23th, 2022.
- [110] "Learning in the quantum universe". Invited Talk at YQI/CS Quantum Computing Colloquium, Yale University, Nov. 18th, 2022.
- [111] "Learning many-body Hamiltonians with Heisenberg-limited scaling". Invited Talk at IQUS Workshop, University of Washington, Nov. 16th, 2022.
- [112] "Learning in the quantum universe". Invited Talk at International Olympiad Advanced Science and Engineering Conference, National Taiwan Normal University, Nov. 11th, 2022.
- [113] "Learning to predict arbitrary quantum processes". Invited Talk at Quantum Colloquium, Simons Institute for the Theory of Computing, Nov. 8th, 2022.
- [114] "Learning in the quantum universe". Invited Talk at Quantum Matter Seminar, Caltech, Nov. 7th, 2022.
- [115] "Theory of learning in the quantum universe". Invited Talk at Q-FARM Seminar, Stanford University, Nov. 2nd, 2022.
- [116] "Learning and making predictions in a quantum world". Invited Talk at Quantum Innovators in computer science and mathematics, University of Waterloo, Oct. 18th, 2022.
- [117] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Quantum Photonics, Clubhouse, Oct. 1st, 2022.
- [118] "Provably efficient machine learning for quantum many-body problems". Invited Talk at the Center for Quantum Science and Engineering, National Taiwan University, Sep. 30th, 2022.
- [119] "Quantum advantage in learning from experiments". Invited Talk at Hybrid Quantum Classical Computation workshop hosted by Andris Ambainis, Sep. 14th, 2022.

- [120] "Quantum advantage in learning from experiments". Invited Talk at the Joint Colloquium, National Taiwan University, Sep. 13th, 2022.
- [121] "Quantum advantage in learning from experiments". Invited Talk at 17th Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC-22), Jul. 11th, 2022.
- [122] "Quantum advantage in learning from experiments". Invited Lecture at Los Alamos Quantum Computing Summer School, Jul. 7th, 2022.
- [123] "Quantum advantage in learning from experiments". Invited Talk at MediaTek, Jul. 3rd, 2022.
- [124] "Quantum advantage in learning from experiments". Invited Talk at IBM Qiskit Quantum Seminar, Jun. 24th, 2022.
- [125] "Learning from quantum experiments". Invited talk, Quantum and Lattices Joint Reunion Workshop at Simons Institute, Jun. 14th, 2022.
- [126] "Foundations for learning from noisy quantum experiments". Invited talk, Quantum Research Seminars Toronto, May. 31st, 2022.
- [127] "Quantum advantage in learning and making predictions". Invited Banquet Talk at QSC Quantum Algorithms Workshop, May. 19th, 2022.
- [128] "Quantum advantage in learning from experiments". Contributed Talk at Caltech Balleroy Meeting, May. 13th, 2022.
- [129] "Quantum advantage in learning from experiments". Invited Talk at CIFAR QIS program meeting, Apr. 22nd, 2022.
- [130] "Quantum advantage in learning from experiments". Invited Talk at Quantum Science Center Hot Topics Talk, Apr. 14th, 2022.
- [131] "Quantum advantage in learning from experiments". Invited Talk at QuICS, University of Maryland, Apr. 8th, 2022.
- [132] "Predicting many properties of a quantum system from very few measurements". Invited Talk at Lawrence Berkeley National Laboratory, Mar. 31st, 2022.
- [133] "Power of data in quantum machine learning". Invited Talk at QuEra, Mar. 31st, 2022.
- [134] "Quantum advantage in learning from experiments". Invited Talk at Harvard Quantum Initiative Special Seminar, Mar. 25th, 2022.
- [135] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Math Picture Language Seminar, Mar. 22nd, 2022.
- [136] "Making predictions in a quantum world". Invited Talk at APS March Meeting, Mar. 18th, 2022.
- [137] "Foundations for learning from noisy quantum experiments". Contributed talk, 25th Annual Conference on Quantum Information Processing (QIP-22), Mar. 7th, 2022.
- [138] "Provably efficient machine learning for quantum many-body problems". Plenary talk, 25th Annual Conference on Quantum Information Processing (QIP-22), Mar. 7th, 2022.
- [139] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at PsiQuantum, Mar. 1st, 2022.
- [140] "Predicting many properties of quantum systems from very few measurements". Invited Talk at Graeme Smith's group at CU Boulder / JILA. Feb. 22th, 2022.

- [141] "Making predictions in a quantum world". Invited Talk at CTQM Seminar, CU Boulder / JILA. Feb. 18th, 2022.
- [142] "Quantum advantage in learning from experiments". Invited Talk at Los Alamos National Laboratory. Jan. 20th, 2022.
- [143] "Making predictions in a quantum world". Invited Talk at Quantum Colloquium, Simons Institute for the Theory of Computing. Nov. 30th, 2021.
- [144] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Shivaji Sondhi's group at Oxford University. Nov. 19th, 2021.
- [145] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at the International Conference on Quantum Techniques in Machine Learning (QTML), Nov. 9th, 2021.
- [146] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Perimeter Institute. Oct. 20th, 2021.
- [147] "Provably efficient machine learning for quantum many-body problems". Invited Talk at the Quantum Creators Prize Symposium. Sep. 29th, 2021.
- [148] "Provably efficient machine learning for quantum many-body problems". Invited Talk at QuSoft. Sep. 17th, 2021.
- [149] "Provably efficient machine learning for quantum many-body problems". Invited Talk at MIT / Harvard QML Journal Club. Sep. 2nd, 2021.
- [150] "Power of data in quantum machine learning". Invited Talk at QML Meetup. Aug. 26th, 2021.
- [151] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Technical University of Munich. Jul. 26th, 2021.
- [152] "Experimental advantage in learning with noisy quantum memory". Invited Talk at Google Quantum Summer Symposium. Jul. 22nd, 2021.
- [153] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Simons Institute for the Theory of Computing. Jul. 15th, 2021.
- [154] "How can we estimate properties of many-body quantum states in a Rydberg-atom system?". Theory Talk at Quantum Systems Accelerator meetings. Jul. 14th, 2021.
- [155] "Experimental advantage in learning with noisy quantum memory". Invited Talk at Google Quantum AI Theory Meeting. Jul. 13th, 2021.
- [156] "Provably efficient machine learning for quantum many-body problems". Invited Talk at Max Planck Institute of Quantum Optics. Jul. 13th, 2021.
- [157] "Predicting many properties of quantum systems from very few measurements". Invited Talk at Cornell University. May 20th, 2021.
- [158] "Recent advances on predicting properties of quantum many-body systems". Invited Talk at Peking University. May 12th, 2021.
- [159] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at IBM Research, May 5th, 2021.
- [160] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at Microsoft Research, Apr. 26th, 2021.
- [161] "Making predictions in the quantum world". Invited talk at Quantum Information Processing Seminar, Massachusetts Institute of Technology, Apr. 23rd, 2021.

- [162] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at Duke University, Apr. 16th, 2021.
- [163] "Characterizing quantum advantage in machine learning". Invited Talk at Scientific Machine Learning Series, Carnegie Mellon University. Apr. 15th, 2021.
- [164] "Power of data in quantum machine learning". Invited Talk at Rigetti Computing. Apr. 14th, 2021.
- [165] "Recent advances on predicting properties of quantum many-body systems". Invited Talk at the 6th International Conference for Young Quantum Information Scientists. Apr. 12th, 2021.
- [166] "Fundamental aspects of solving quantum problems with machine learning". Los Alamos National Laboratory, Mar. 25th, 2021.
- [167] "Power of data in quantum machine learning". APS March Meeting, Mar. 18th, 2021.
- [168] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at IST seminar series on Mathematics, Physics & Machine Learning, Mar. 17th, 2021.
- [169] "Power of data in quantum machine learning". Invited talk at SIAM Conference on Computational Science and Engineering, Mar. 3rd, 2021.
- [170] "Fundamental aspects of solving quantum problems with machine learning". Caltech Institute for Quantum Information and Matter (IQIM) Seminar, Feb. 26th, 2021.
- [171] "Fundamental aspects of solving quantum problems with machine learning". QuICS Seminar, University of Maryland, Feb. 17th, 2021.
- [172] "Fundamental aspects of solving quantum problems with machine learning". Contributed talk, 24rd Annual Conference on Quantum Information Processing (QIP-21), Jan. 30-31, 2021.
- [173] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at National Tsing Hua University, Jan. 12th, 2021.
- [174] "Information-theoretic bounds on quantum advantage in machine learning". Invited talk at Academia Sinica, Jan. 8th, 2021.
- [175] "Predicting Many Properties of a Quantum System from Very Few Measurements", National Taiwan University, Center for Quantum Science and Engineering, Dec. 18th, 2020.
- [176] "Predicting Many Properties of a Quantum System from Very Few Measurements", University College London, Quantum Information Seminar, Nov. 27th, 2020.
- [177] "Power of data in quantum machine learning", Centre for Quantum Technologies, Quantum Machine Learning Seminar, Nov. 26th, 2020.
- [178] "Predicting Many Properties of a Quantum System from Very Few Measurements", Caltech Institute for Quantum Information and Matter (IQIM) Seminar, Apr. 17th, 2020.
- [179] "Predicting Features of Quantum Systems using Classical Shadows", Single-track talk, 23rd Annual Conference on Quantum Information Processing (QIP-20), Jan. 6-10, 2020.
- [180] "Understanding Machine Reading Comprehension", Invited Talk, Academia Sinica, Oct 16, 2017.
- [181] "A Unified Algorithm for One-class Structured Matrix Factorization with Side Information", 31st AAAI Conference on Artificial Intelligence (AAAI-17), Feb. 4-9, 2017.
- [182] "Linear and Kernel Classification: When to Use Which?", SIAM International Conference on Data Mining (SDM16), May 5-8, 2016.

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- [183] "Linear and Kernel Classifier: When to Use Which?", Spotlight presentation (acceptance rate: 11%), Machine Learning Summer School (MLSS'15), Kyoto University, August 23-September 4, 2015.
  - [184] "Brief Introduction to Automatic Machine Learning", Science Exploration Forum, National Taiwan University, August 11, 2015.
  - [185] "Dissecting Human Protein-Protein Interaction Network via Phylogenetic Decomposition." 14th International Conference on Systems Biology (ICSB2013), August 30-September 3, 2013.