

# Feng Pan

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## Research Interests

**Computational Quantum Physics, Statistical Physics, Tensor Network Algorithm, AI for Physics, Quantum Computing, Quantum Machine Learning, Quantum Error Correction.**

## Academic Positions

- Jan 2025 - **Assistant Professor**, *Singapore University of Technology and Design*.  
Present
- Aug 2023 - **Postdoctoral Research Fellow**, *Centre for Quantum Technologies, National University of Singapore*,  
Dec 2024 Advisor: Prof. Patrick Rebentrost.
- Feb 2023 - **Visiting Scholar**, *CAS Center For Excellence in Quantum Information and Quantum Physics, University of Science and Technology of China*,  
Jul 2023 Host: Prof. Chaoyang Lu and Prof. Jianwei Pan.
- July 2022 - **Visiting Scholar**, *Institute of Theoretical Physics, Chinese Academy of Sciences*,  
Jan 2023 Host: Prof. Pan Zhang.

## Education

- Sep 2017 - **Institute of Theoretical Physics, Chinese Academy of Sciences, Beijing**,  
Jul 2022 *PhD in Theoretical Physics*, Supervisor: Prof. Pan Zhang.
- Sep 2015 - **Massachusetts Institute of Technology, Cambridge**,  
Jan 2016 *Exchange Student*, Physics.
- Sep 2012 - **Nanjing University of Aeronautics and Astronautics, Nanjing**,  
Jun 2016 *Bachelor of Science*, Mathematics & Physics.

## Service

- Journal Referee Physical Review Letters, Physical Review A, Physical Review B, Quantum
- Conference Referee Conference on the Theory of Quantum Computation, Communication and Cryptography (TQC)

## Awards

- 2023 Second Prize of Beijing Natural Science Award.
- 2023 Outstanding Doctoral Dissertation Award of Beijing.
- 2023 Outstanding Doctoral Dissertation Award of the Chinese Academy of Sciences.
- 2021 National Scholarship for Doctoral Students, Ministry of Education of China.
- 2021 Principal Scholarship, Chinese Academy of Sciences.
- 2013 National Scholarship for Bachelor Students, Ministry of Education of China.

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## Publications

I have authored 9 journal articles, 1 conference proceeding, in addition to 4 preprint papers. Notably, 4 of these articles have been published in Physical Review Letters, the leading journal in the field of Physics. Detailed information about my publications can be found on [Google Scholar](#).

### Peer-reviewed Journal Articles:

- [1] **Feng Pan**, Henry Gu, Lvlin Kuang, Bin Liu, Pan Zhang, *Efficient quantum circuit simulation by tensor network methods on modern gpus*, [ACM Transactions on Quantum Computing](#), Volume 5, Issue 4 (2024).
- [2] Xian-He Zhao, Han-Sen Zhong, **Feng Pan**, et. al., *Leapfrogging Sycamore: Harnessing 1432 GPUs for 7× faster quantum random circuit sampling*, [National Science Review](#), nwae317 (2024).
- [3] Yijia Wang, Yuwen Ebony Zhang, **Feng Pan**, Pan Zhang, *Tensor Network Message Passing*, [Phys. Rev. Lett.](#) **132**, 117401. (2024) (Editors' Suggestion).
- [4] **Feng Pan**, Keyang Chen, and Pan Zhang, *Solving the Sampling Problem of the Sycamore Quantum Circuits*, [Phys. Rev. Lett.](#) **129**, 090502. (2022) (Editors' Suggestion).

Media highlights: [Science](#), [The Quantum Insider](#), [New Scientist](#).

- [5] **Feng Pan**, and Pan Zhang, *Simulation of quantum circuits using the big-batch tensor network method*, [Phys. Rev. Lett.](#) **128**, 030501 (2022). (Editors' Suggestion).

Blog discussions: [Scott Aaronson](#), [Gil Kalai](#).

- [6] Sujie Li, **Feng Pan**, Pengfei Zhou, and Pan Zhang, *Boltzmann machines as two-dimensional tensor networks*, [Phys. Rev. B.](#) **104**, 075154 (2021).
- [7] **Feng Pan**, Pengfei Zhou, Hai-Jun Zhou and Pan Zhang, *Solving statistical mechanics on sparse graphs with feedback-set variational autoregressive networks*, [Phys. Rev. E.](#) **103**, 01203 (2021).
- [8] **Feng Pan**, Pengfei Zhou, Sujie Li and Pan Zhang, *Contracting arbitrary tensor networks: General approximate algorithm and applications in graphical models and quantum circuit simulations*, [Phys. Rev. Lett.](#) **125**, 060503 (2020).
- [9] Ya-Peng Hu, **Feng Pan**, and Xin-Meng Wu, *The effects of massive graviton on the equilibrium between the black hole and radiation gas in an isolated box*, [Phys. Lett. B](#) **772**, 553-558 (2017).

### Peer-reviewed Conference Proceedings:

- [10] Rong Fu, Zhongling Su, Han-Sen Zhong, Xiti Zhao, Jianyang Zhang, **Feng Pan**, et. al., *Surpassing Sycamore: Achieving Energetic Superiority Through System-Level Circuit Simulation*, [SC24: International Conference for High Performance Computing, Networking, Storage and Analysis](#).

### Preprints:

- [11] Naixu Guo, **Feng Pan**, Patrick Rebentrost, *Estimating properties of a quantum state by importance-sampled operator shadows*, [arxiv:2305.09374](#).
- [12] Hanyan Cao, **Feng Pan**, Yijia Wang, Pan Zhang, *qecGPT: decoding Quantum Error-correcting Codes with Generative Pre-trained Transformers*, [arxiv:2307.09025](#).
- [13] Zi-Song Shen, **Feng Pan**, Yao Wang, et. al., *Free-Energy Machine for Combinatorial Optimization*, [arxiv:2412.09285](#).
- [14] Hanyan Cao, Shoukuan Zhao, Dongyang Feng, Zisong Shen, Haisheng Yan, Tang Su, Weijie Sun et al. *Exact Decoding of Repetition Code under Circuit Level Noise*, [arXiv:2501.03582](#).

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## Selected Talks

- Feb 2024 **Arbitrary Tensor Network Algorithm: Theory, Methods and Applications**  
Invited talk at IPAM workshop TNK 2024, UCLA, Los Angeles, USA, [Talk link](#).
- Oct 2023 **Classical Simulation of Quantum Circuits by Arbitrary Tensor Network Algorithms**  
Prof. Jens Eisert Group, Online.
- Sep 2023 **Classical Simulation of Quantum Circuits by Arbitrary Tensor Network Algorithms**  
Centre for Quantum Technologies, Singapore.

Nov 2021 **Contracting Arbitrary Tensor Networks: Approximate and Exact Approach with Applications in Graphical Models and Quantum Circuit Simulations**  
Perimeter Institute, Waterloo, Canada, [Talk link](#).

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## Patents

- [1] Pan Zhang, **Feng Pan**, Methods, devices and quantum virtual machines for simulating probabilistic amplitudes of quantum states, CN114254755, 2022.