Zhide Lu

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EDUCATION

2019 – **Ph.D. student, Center for Quantum Information, IIIS, Tsinghua University**
Advisor: Prof. Dong-Ling Deng
Research direction: Quantum artificial intelligence; Quantum computation

2015 – 2019 **B.S., University of Science and Technology Beijing**
Major: Applied physics
Thesis: *Quantum neural networks and quantum many-body problems*

PUBLICATIONS

1) Markovian Quantum Neuroevolution for Machine Learning
Zhide Lu[*1], Pei-Xin Shen[*], and Dong-Ling Deng[†]
Phys. Rev. Applied 16, 044039 (2021)

2) Deep quantum neural networks on a superconducting processor
Xiaoxuan Pan[*], **Zhide Lu**[*], Dong-Ling Deng[†], Luyan Sun[†], et al.
Nat. Commun. 14, 4006 (2023)

3) Quantum continual learning overcoming catastrophic forgetting
Wenjie Jiang, **Zhide Lu**, and Dong-Ling Deng[†]
Chinese Phys. Lett. 39 050303 (2022)

4) Quantum neural network classifiers: A tutorial
Weikang Li[†], **Zhide Lu**, and Dong-Ling Deng[†]
SciPost Phys. Lect. Notes 61 (2022) [Code]

5) Adversarial learning in quantum artificial intelligence
Pei-Xin Shen, Wenjie Jiang, Weikang Li, **Zhide Lu**, and Dong-Ling Deng[†]
Acta Phys. Sin., 2021, 70: 140302 (2021) (Invited review in Chinese)

6) Expressibility-induced concentration of quantum neural tangent kernels
Li-Wei Yu[†], Weikang Li, Qi Ye, **Zhide Lu**, Zizhao Han, and Dong-Ling Deng[†]
arXiv:2311.04965 (2023)

[1] * for co-first authors, and † for corresponding authors.

REASEARCH INTERESTS

My research focuses on the interplay between quantum information, artificial intelligence (AI), and quantum physics. On the one hand, a range of tools and ideas from AI can be applied to solve complex quantum problems. On the other hand, quantum computing also brings unprecedented opportunities to enhance or innovate AI algorithms. My specific research directions include:

- **Quantum-Enhanced machine learning**

  – Designing new quantum machine learning algorithms that offer quantum speed-ups over their classical counterparts
  – Finding machine learning problems that show unambitious complexity separation between quantum and classical algorithms

- **Machine learning for quantum physics**

  – Solving quantum many-body problems, such as finding the system's ground state and simulating its dynamics
  – Developing explainable, trustworthy machine learning methods
  – Developing efficient methods searching for the quantum circuit architectures

CONFERENCES & TALKS

1) The 12th International Conference on Computing and Pattern Recognition (2023)

Invited talk: *Recent Progress on Deep Quantum Neural Networks*

2) APS March Meeting 2023, Virtual

Contributed talk: *Markovian Quantum Neuroevolution for Machine Learning*

3) Progress in Electromagnetics Research Symposium (Prague, Czech, 2023)

Contributed talk: *Deep Quantum Neural Networks on a Superconducting Processor*

4) The 2nd International Conference on Emerging Quantum Technology (2023)

Poster: *Deep quantum neural networks on a superconducting processor*

5) The 6-th International Conference on "Quantum Information, Spacetime, and Topological Matter" (2021)

Poster: *Markovian Quantum Neuroevolution for Machine Learning*

ACADEMIC SERVICES

- **Journal Referee**

  – Nature Communications
  – Physical Review Letters
  – Physical Review A
  – Advanced Quantum Technologies
  – Science China Physics, Mechanics & Astronomy
  – Acta Physica Sinica

RELEVANT GRADUATE COURSES

- **Tsinghua University**

  Quantum Computation: Concept and Architecture, 4.0/4.0

  Quantum Artificial Intelligence, 4.0/4.0

  Selected Topics in Computational Quantum Physics, 3.6/4.0

AWARDS & ACHIEVEMENTS

2023.10 Friends of Tsinghua - The Toyota Scholarship

2022.10 The Scholarship of the Institute for Interdisciplinary Information Sciences

2021.10 The Scholarship of the Institute for Interdisciplinary Information Sciences

2017.11 Contemporary Undergraduate Mathematical Contest in Modeling
First Prize in Beijing area

2017.03 The 8th Mathematics competition of Chinese College Students
First Prize