Langxu Bai

lbai2@ncsu.edu • langxubai.github.io[1]

RESEARCH INTERESTS & PROFESSIONAL SUMMARY

Quantum Information Theory, Quantum Computing especially Quantum Machine Learning and Quantum Signal Processing
My future research interests include the geometrical structure of quantum information.
Coding Skills: C++, python(opencv, scipy, numpy, scikit-learn, pytorch), MATLAB and Mathematica.

EDUCATION

Bachelor's Degree Sept 2021 - Present

School of Physics, Nankai University, China Major Grade: 86.7/100 Rank:16%

Advanced Courses: Advanced Quantum Mechanics, Advanced Physics Experiments, Lie Group Theory, Quantum Field Theory, Special Functions, Soft Condensed Matter Physics, Advanced Statistical Mechanics.

RESEARCH EXPERIENCE

Investigating Stochastic Quantum Signal Processing July 2024 - Present

Prof. Yuan Liu | *Electrical & Computer Engineering, North Carolina State University*

- Developed a framework for Stochastic Quantum Signal Processing by integrating phase angle distributions with polynomial coefficient distributions.
- Derived analytical expressions to explore the relationship between stochastic variations in quantum phases and their effects on polynomial structures.
- Applied this approach to optimize probabilistic quantum algorithms and enhance robustness against noise.

Investigating Presence and Absence of Barren Plateaus in Quantum Fisher Kernel Oct 2023 - Present

Prof. Li-Wei Yu | *Chern Institute of Mathematics, Nankai University*

- Focused on the Barren Plateaus phenomenon in quantum fisher kernel algorithm in Matrix Product State systems.
- Encountered the Barren Plateaus phenomenon, where the training of quantum neural networks is impeded due to the vanishing of both the mean and variance of the loss function's gradient.
- Utilized the quantum Fisher kernel algorithm to compute the mean and variance corresponding to the Matrix Product State model under both local and global loss functions to assess whether the Barren Plateau phenomenon persists.

Investigating Tensor Networks Algorithms in Quantum Physics and Machine Learning Summer 2023

Prof. Pan Zhang | *Institute of Theoretical Physics, Chinese Academy of Sciences*

- Mastered the fundamentals of tensor networks theory, encompassing tensor decompositions such as Canonical Polyadic Decomposition, Tucker Decomposition, and Higher-Order Singular Value Decomposition.
- Gained proficiency in Density Matrix Renormalization Group algorithms, infinite DMRG, and a foundational understanding of tensor network construction and its diverse applications in quantum physics and machine learning.
- Acquired relevant skills in programming tools and software to classically simulate quantum processors efficiently using ITensor(C++) and JuliaTensor (Julia).

ACADEMIC EXPERIENCE

Developing Gainless Parity-time Symmetric Optical System 2023

Prof. Huanan Li | *Nankai University*

- Focused on the realization of unique scattering phenomena in parity-time symmetric optical systems under evanescent wave excitations.
- Targeted on studying the effective Hamiltonian of the systems which is derived using the quasi-normal mode method.
- Simulated parity-time symmetric optical systems under evanescent wave excitations with Mathematica.

Investigating Quantum Phase Transition in Open Quantum Systems Summer 2023

Prof. Shu Chen | *Institute of Physics, Chinese Academy of Sciences*

[1]For the latest information, please visit my personal pages.

- Learnt the basics of superconductivity theory including London Theory, Ginzburg-Landau Theory, BCS Theory, and Density Functional Theory.
- Accomplished the Monte-Carlo simulation of the two-dimensional Ising model, two-dimensional solution lattice model, and two-dimensional non-lattice Lennard-Jones interaction particle motion.

Participating in Quantum Computing Talent Training Plan Summer 2023

Prof. Zhaofeng Su | *University of Science and Technology of China*

- Quantum Computing Talent Training Plan is an honored program for quantum computing seminars organized by Prof. Su.
- Learnt the basics through the Chap. 1 - 6 of *Quantum Computation and Quantum Information, Nielsen M A, Chuang I L*.

HONORS

National Astronomical Observatories Scholarship | *Chinese Academy of Sciences* May 2024

Outstanding Student Award(awarded for top 10% students) | *School of Physics, Nankai University* Oct 2023

Third Prize of Nankai University Young Physicists' Tournament | *Nankai University* May 2023

Nankai University Scholarship | *Nankai University* Sept 2022