

Zanqiu Shen

Curriculum Vitae

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Research interests

Quantum information theory, Quantum computing, Quantum sensing, Ultraviolet communications.

Education

- 2022–present **PhD, Electrical & Computer Engineering**, *University of Toronto*, Toronto, Canada.
Advised by Amr S. Helmy
Focus areas: quantum sensing and quantum optics
- 2018–2021: **Master of Engineering, Instrument & Meter**, *Tsinghua University*, Beijing/Shenzhen, China.
Focus areas: ultraviolet communications
Advised by Jianshe Ma and Ping Su
- 2014–2018: **Bachelor of Engineering, Measurement & Control Technology**, *Harbin University of Science and Technology*, Harbin, China.
Specialized area: photoelectric information
Advised by Zimei Su and Lihua Wu

Research and Development Experience

- 01/2024 – **Research on Magic State Distillation.**
present Ongoing
Advisor : **Prof. Xin Wang**, *Associate Professor, Thrust of Artificial Intelligence, Information Hub*, Hong Kong University of Science and Technology (Guangzhou)
- 10/2022 – **Research and Development on Performance Evaluation of Quantum Devices.**
12/2023 Implemented the direct fidelity estimation method for both quantum state and quantum process; designed protocols including multiple importance sampling, optimal dual frame and operator Schmidt decomposition to improve fidelity estimation; proposed and implemented efficient measurement fidelity estimation methods using local states.
Mentor : **Dr. Kun Wang**, *Senior Researcher, Quantum Error Processing (QEP) Team, Institute for Quantum Computing*, Baidu Research
- 09/2022 – **Research on Quantum Illumination.**
present Perform the literature review for quantum illumination; reproduced the estimation methods of reflected coefficient in quantum illumination.
Advisor : **Prof. Amr Helmy**, *Professor, Department of Electrical & Computer Engineering*, University of Toronto
- 07/2022 – **Research on real-time operating system.**
09/2022 Performed literature review on the improvement of Linux real-time performance.
Mentor : **Mr. Xuyang Zhang**, *Manager, Department of real-time platform*, Hirain
- 10/2020 – **Study on Receiver Signal Processing for Ultraviolet Scattering Communication .**
06/2021 Proposed a nonlinear minimum mean square error receiver; utilized subcarrier intensity modulation to reduce bit error rates.
Advisor : **Prof. Jianshe Ma and Prof. Ping Su**, *Associate Professor, Department of Instrument & Meter Engineering*, Tsinghua Shzhen International Graduate School

- 09/2018 – **Research on Deep Ultraviolet Scattering Communication Channel** .
 10/2020 Established a new channel model for ultraviolet scattering communication; proposed the first transceiver jitter model in ultraviolet communication; designed a Monte Carlo integration model which featured significant improvements.
 Advisor : **Prof. Jianshe Ma**, Associate Professor, Department of Instrument & Meter Engineering, Tsinghua Shzhen International Graduate School
- 08/2020 – **Study on Policy Evaluation and Control of Reinforcement Learning for Blackjack** .
 10/2020 Wrote the code of a reinforcement learning algorithm for Blackjack game; compared the performance of different reinforcement learning algorithm.
 Advisor : **Prof. Pietro Lio**, Professor, Department of Computer Science, University of Cambridge
- 04/2017 – **Research on State Recognition for Cardiovascular System Based on Pulse Wave** .
 07/2018 Clearly defined the pulse wave as Gaussian mixture model; utilized a Gradient Boosting Decision Tree to identify the state of the cardiovascular system.
 Advisor : **Prof. Zimei Su**, Professor, Department of Measurement & Control Technology, Hrbust

Publications

Submitted articles

- 2023 **Zanqiu Shen** and Kun Wang, Fidelity Estimation of Entangled Measurements with Local States. Submitted to *arXiv: 2312.13730*
- 2022 **Zanqiu Shen**, Jianshe Ma, Tianfeng Wu, Tao Shan, Yupeng Chen, and Ping Su, Ultraviolet scattering communication using subcarrier intensity modulation over atmospheric turbulence channels, Submitted to *arXiv:2212.00611*.

Journal Articles

- 2021 **Zanqiu Shen**, Jianshe Ma, and Ping Su. Lmmse-based simo receiver for ultraviolet scattering communication with nonlinear conversion. *IEEE Wireless Communications Letters*, volume 10, pages 2140–2144. IEEE, 2021.
- 2020 **Zanqiu Shen**, Jianshe Ma, Serge B Provost, and Ping Su. Effects of transceiver jitter on the performance of optical scattering communication systems. *Optics Letters*, volume 45, pages 5680–5683. Optica Publishing Group, 2020.
- 2020 Tao Shan, Jianshe Ma, Tianfeng Wu, **Zanqiu Shen**, and Ping Su. Single scattering turbulence model based on the division of effective scattering volume for ultraviolet communication. *Chinese Optics Letters*, volume 18, page 120602. Chinese Optical Society, 2020.
- 2020 Tao Shan, Jianshe Ma, Tianfeng Wu, **Zanqiu Shen**, and Ping Su. Modeling of ultraviolet omni-directional multiple scattering channel based on monte carlo method. *Optics Letters*, volume 45, pages 5724–5727. Optica Publishing Group, 2020.
- 2019 **Zanqiu Shen**, Jianshe Ma, Tao Shan, and Tianfeng Wu. Modeling of ultraviolet scattering propagation and its applicability analysis. *Optics letters*, volume 44, pages 4953–4956. Optica Publishing Group, 2019.

In Conference Proceedings

- 2020 **Zanqiu Shen**, Jianshe Ma, Tao Shan, and Ping Su. Improved monte carlo integration models for ultraviolet communications. In *2020 IEEE 20th International Conference on Communication Technology (ICCT)*, pages 168–172. IEEE, 2020.

Talks

- 10/2020 **ICCT2020**, improved monte carlo integration models for ultraviolet communication.

Patents

Submitted patents

- 2023 Kun Wang, **Zanqiu Shen**, *Quantum state inner product estimation scheme based on operator Schmidt decomposition*, Submitted.
- 2023 Kun Wang, **Zanqiu Shen**, *Quantum state fidelity estimation scheme based on near-optimal data post-processing*, Submitted.
- 2023 Kun Wang, **Zanqiu Shen**, *Quantum state fidelity estimation scheme based on basis transformation*, Submitted.
- 2023 Kun Wang, **Zanqiu Shen**, *Quantum state fidelity estimation scheme based on multiple importance sampling*, Submitted.

Under review patents

- 2023 Kun Wang, **Zanqiu Shen**, *Method and apparatus for determining the fidelity of quantum states, electronic devices, and media*, CN116739099A.
- 2023 Kun Wang, **Zanqiu Shen**, *Efficient method and apparatus for estimating the performance of quantum measurement device, electronic devices, and media*, CN116739098A.
- 2023 Kun Wang, **Zanqiu Shen**, *Method and apparatus for estimating the performance of quantum measurement device, electronic devices, and media*, CN116739097A.

Authorized patents

- 2019 Jianshe Ma, **Zanqiu Shen**, Ping Su, Tao Shan, Tianfeng Wu, *A non-line-of-sight communication channel modeling method*, CN112543074A.
- 2019 Jianshe Ma, **Zanqiu Shen**, Ping Su, Tao Shan, Tianfeng Wu, *A method for calculating the bit error rate of non-line-of-sight communication links*, CN112543051A.
- 2018 Zimei Su, Zicong Miao, Bing Deng, Zhilin Gan, **Zanqiu Shen**, *Real-time monitoring system of cardiovascular diseases based on pulse wave*, CN108618765B.
- 2017 Chunyu Yu, Peng Lei, Shouqiang Kang, **Zanqiu Shen**, *Design of a six-dimensional fractional-order hyperchaotic system and chaotic signal generator*, CN107359980B.

Fellowships & Awards

- 2022 –present **ECE Graduate Fellowship**, as a PhD student in University of Toronto.
- 2020 *Recipient of **National Scholarship of China*** at Tsinghua University.
- 2020 *Recipient of **Excellent Oral Presentation Certificate*** in *IEEE 20th International Conference on Communication Technology*, Nanning, China
- 2019 **Comprehensive Excellence Scholarship** at Tsinghua University.
- 2018 **Excellent Graduation Thesis** award at Hrbust.
- 2017 **Provincial Prize of the National Software and Information Technology Competition**, Heilongjiang Province, China.
- 2016 *Recipient of **Ruyuan Talent Scholarship*** sponsored by Beijing Alumni Association, the highest scholarship at Hrbust. Only 8 awarded each year.
- 2016 *Recipient of **National Scholarship of China*** at Hrbust.
- 2016 *Recipient of **Scholarship of Chinese Instrument and Control Society***, China.
- 2016 **National First Prize of Mathematical Modeling Contest**, China.

Academic service

Journal reviewer for Ultraviolet communications: IEEE Transactions on Communications, IEEE Wireless Communication Letters, IEEE Communication Letters, Optics Express, Applied Optics.

Teaching Assistantship

Spring, 2020 : **Precision Measurement and Metrology**, Tsinghua University.

Fall, 2019 : **Test and Measurement Technology**, Tsinghua University.

Computer skills

Languages Python, Matlab, C/C++.

Frameworks QCompute, QEP, Qiskit.

Referees

Dr. Kun Wang

*Senior Researcher, Institute of
Quantum Computing*

Baidu Research

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Prof. Jianshe Ma

*Associate Professor, Department of
Instrument & Meter Engineering*

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Prof. Ping Su

*Associate Professor, Department of
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Prof. Leshao Mao

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Precision Instrument*

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