Zi-Jian Zhang

Education

2016–2020 **Undergraduate School**.
Southern University of Science and Technology (SUSTech), Shenzhen, China.
Department of Physics.
- Overall GPA - 3.88/4.0 (Rank: 2/55 in department)
- Supervisor: Man-Hong Yung

2019 summer **Summer research**.
University of Toronto (UofT), Toronto, Canada.
Department of Computer Science & Department of Chemistry.
- Topic: Mutual information-assisted Ansatz Construction in VQE
- Supervisor: Alán Aspuru-Guzik and Thi Ha Kyaw

2013–2016 **High School**.
Shandong Experimental High School, Jinan, Shandong, China.
Top 0.7% in the National College Entrance Examination in Shandong.

Research experience

I carried out intensive independent theoretical research and contributed *most* of the writing and theoretical works in following projects. The topic interests me most is the applications of near-term quantum computers.

Complexity **Group non-membership verification**.
- Proposed a new quantum process to verify the yes instances of group non-membership (GNM) problems, reducing the depth of the quantum circuit needed from $O(n^5)$ to $O(1)$.
- The new process has been demonstrated by our collaborators in USTC using an optic setup as a QMA game.
- I designed the new protocol with my collaborators. I proved the soundness and completeness of the new protocol.

Chemistry **Mutual information in VQE**, *arXiv:2008.07553*.
- Proposed a method for adaptive ansatz construction in VQE. The new method can take advantage of approximated pairwise mutual information between qubits.
- This is the first VQE algorithm that utilizes wavefunction approximated by classical method (to the best of our knowledge).
- I designed the algorithm and implemented it by ProjectQ. The numerical experiments are also carried out and analyzed by me.

Software **Programming framework for adaptive quantum circuit**, *Mizore*.
- I am developing the programming framework *Mizore* for adaptive ansatz construction in VQE, in which the quantum circuit grows in a optimal way to obtain lower energy estimation with less gate count.
- I designed the framework and contributed more than $2/3$ codes. Based on Mizore, I plan to try adaptive circuit construction technique on quantum subspace diagonalization (QSD), autoencoder (and other quantum ML) and quantum variational simulation (QVS).

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Teaching Experience

Teaching Assistant — **Quantum Computing**, *2020 Spring*, SUSTech, with Prof. Man-Hong Yung.

- Design programming homework (In English, independently and solo).
- Help the students learn Python and quantum programming (ProjectQ).
- Give tutorial on the homework (In English).

Awards

2020 Excellent Undergraduate Thesis (Ranked first) - Department of Physics, SUSTech

2020 Outstanding Graduates - Department of Physics, SUSTech

2018 Excellent Undergraduate First Prize - SUSTech

2017 Excellent Undergraduate First Prize - SUSTech

2015 32th Chinese Physical Olympiad (in Provinces)- Second Prize - Chinese Physical Society

2014 National Olympiad in Informatics in Provinces (NOIP) - Second Prize - China Computer Federation

Languages

English TOEFL:102, GRE: 330 (V160+Q170)+AW3.0

Japanese Elementary

Chinese Mother tongue