Jaeyong Hwang

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Education

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, South Korea

B.S. candidate in Physics, *Summa Cum Laude* Mar. 2017 - Feb. 2023

- Thesis title: *New Rydberg Atom Structure for Quantum Computing in any non-planar graph: Quantum Tree Wire*
- Military service: Korean Augmentation To the United States Army (KATUSA), platoon leader Nov. 2018 – Jun. 2020

Research Interests

- **Atom-Light Interaction**
- **Quantum Algorithm and Quantum Simulation**
- **Neutral Atom Quantum Computing**
- **Quantum Optics**

Research Experience

Opto-Quantumics (OQT) Lab, KAIST Mar. 2022 - Present

PI: Prof. Donggyu Kim

- Developing a methodology for fast Quantum Non-demolition (QND) measurement of reusable neutral atom qubits with its phase information.
- Fast solution of combinatorial optimization problems in the Hubbard model using both classical and quantum devices.
- Construction of experiment setup: Double-pass AOM and laser intensity lock system.

Center for Supersolid and Quantum Matter Research (CSQR), KAIST Jan. 2022 - Feb. 2022

PI: Prof. Eunseong Kim

- Study on building superconductor-based 3D cavity to construct circuit QED system.
- More effective Quantum Non-demolition (QND) measurement construction.

Quantum Computing Lab (QCL), KAIST Sep. 2020 - Dec. 2021

PI: Prof. Jaewook Ahn

- Study on quantum computing Maximum Independent Set (MIS) problem, or Max-Cut problem using 3D arranged Rydberg atom array.
- Three projects:
  - Experimental realization of Quantum Approximate Optimization Algorithm (QAOA) on solving MIS and Max-Cut problem
  - Quantum Tree Wire implementation on Rydberg atom systems for a maximum independent set of an arbitrary non-planar graph (published in *Nature Physics,* Best Oral Presentation Award in KPS conference)
  - Designing an arbitrary unitary quantum gate using Rydberg blockade and intended avoided crossing
- Undergraduate Research Project (URP) Grand Prix, 1 Best Oral Presentation Award, and 4 Conference Presentations

Electronic structure Research Laboratory (ER Lab), KAIST Mar. 2018 - Jun. 2018

PI: Prof. Yeongkwan Kim

- Learned and assisted YBCO synthesis and characterization through extremely cold temperature.

Publications

Minhyuk Kim, Kangheun Kim, **Jaeyong Hwang**, Eun-Gook Moon, and Jaewook Ahn, "Rydberg Quantum Wires for Maximum Independent Set Problems", *Nature Physics* **18**, 755-759 (2022).

Hongseok Oh, Youngbin Tchoe, Heehun Kim, Jiyoung Yun, Mingi Park, Seongjun Kim, Young-soo Lim, Hanjoon Kim, Woosung Jang, **Jaeyong Hwang**, Yeda Song, Juntae Koh, and Gyu-chul Yi, "Large-scale, single-oriented ZnO nanostructure on h-BN films for flexible inorganic UV sensors", *J. Appl. Phys.* **130**, 223105 (2021).

Conferences

Jaeyong Hwang, Minhyuk Kim, Kangheun Kim, Eun-Gook Moon, and Jaewook Ahn. (Oct. 2021). *Rydberg quantum tree wires for vertex-splitting in Quantum computing high-degree graphs*,2021 KPS Fall Meeting (Best Oral Presentation Award)

Jaeyong Hwang, Minhyuk Kim, Kangheun Kim, and Jaewook Ahn. (Jun. 2021). *New Rydberg Atom Structure for Quantum Computing in any non-planar graph: Quantum Tree Wire*, poster session presented at Atomic and Molecular Physics Division Workshop (AMP2021), Korean Physical Society, Yeosu, Republic of Korea.

Minhyuk Kim, Kangheun Kim, **Jaeyong Hwang**, and Jaewook Ahn. (Jun. 2021). *Atomic Quantum Wires in Rydberg Ising graphs*, poster session presented at Atomic and Molecular Physics Division Workshop (AMP2021), Korean Physical Society, Yeosu, Republic of Korea.

Kangheun Kim, Minhyuk Kim, **Jaeyong Hwang**, and Jaewook Ahn. (Apr. 2021*). Quantum computing of maximal independent set problem for non-planar graphs*, oral presentation in 2021 KPS Spring Meeting.

Patent

Minhyuk Kim, Kangheun Kim, **Jaeyong Hwang**, and Jaewook Ahn, (2022). *Method for solving Maximum Independent Set problem using Quantum Computing*, Patent Application (PCT/KR2022/000814).

Honors and Awards (Selected)

- **2022 Global Leadership Awards (creativity), KAIST** Feb. 2022
  An honor awarded for showing an exceptional performance among whole undergraduate/graduate students, KAIST, in the creativity area
- **Leadership Mileage Diamond level, KAIST** Jan. 2022
- **Best Oral Presentation award, Korean Physical Society** Oct. 2021
  "Rydberg quantum tree wires for vertex-splitting in Quantum computing high-degree graphs" at the 2021 KPS Fall Meeting
- **Grand Prix, KAIST Undergraduate Research Project (URP)** Aug. 2021
  First place in Winter/Spring URP presentation, "New Rydberg Atom Structure for Quantum Computing in any non-planar-graph: Quantum Tree Wire"
- **Merit-based Scholarship by Department of Physics, KAIST** Spring & Fall of 2021
- **Dean's list, College of Natural Sciences, KAIST** Spring & Fall of 2021
- **Presidential Science Scholarship, Republic of Korea** 2017 – 2022
  An honor awarded for representing Korean university students majored in science or engineering
- **National Scholarship, KAIST** 2017 – 2022

Teaching Experience

- **Undergraduate Mentor, Freshman Tutoring Program (General Physics)** Mar. 2022 – Dec. 2022
- **Private tutor for high school students** 2017 - Present
  High school Math / Physics, Math / Physics Olympiad, General Physics, Linear Algebra, etc.

Skills / Qualifications

Computer: **MATLAB**, **Python**, C/C++, LTspice, Qiskit, Geogebra, Illustrator

Completed Qubit by Qubit's 2020-2021 Introduction to Quantum Computing Course sponsored by IBM Quantum (October 2020 - May 2021).

Completed Quantum Information Science Summer School held by Quantum Information Research Support Center (26 July 2021 - 5 August 2021).

Participated in GEM Trailblazer Summer Program as an exchange student at Nanyang Technological University (NTU), Singapore (2-27 July 2018).

References

Dr. Donggyu Kim

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Dr. Jaewook Ahn

Professor

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Dr. Chan-Ho Yang

Dean, Professor

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