Hyeonjae Kim

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Researcher at Agency for Defense Development

Research Interests

Quantum sensing, Quantum simulation, Quantum computing

Education

Kyungpook National University (KNU) — Daegu, Republic of Korea
Bachelor of Science in Physics — *Mar. 2020 – Feb. 2024*
Overall GPA: 4.11/4.3 (130 credits) | Major GPA: 4.19/4.3 (71 credits)

Research Experiences

Agency for Defense Development (ADD) — Daejeon, South Korea
Researcher (PI: Dr. Sin Hyuk Yim, Dr. Sangkyung Lee) — *Jun. 2024 – Present*

- Designed and implemented absorption spectroscopy setups for alkali vapor cells and performed theoretical modeling of spectral line shapes.
- Developed software tools for estimating buffer gas pressure and monitoring alkali atom number density from measured spectra.
- Conducted long-term aging tests on cubic glass Rb vapor cells and experimentally verified the lifetime improvement provided by Al_2O_3 wall coatings.
- Implemented a SERF-regime OPM setup and performed Bloch-equation–based modeling to analyze the expected magnetic response and operational parameters.
- Established environmental monitoring systems—vacuum and temperature—and designed mechanical mounts.

Novel Applied Nano Optics Lab — Daegu, South Korea
Research Intern (Advisor: Prof. Junyeob Yeo) — *Jun. 2021 – Jun. 2022*
Research on photo-electrochemical cells using lasers

High Energy Physics Lab (Moon Lab) — Daegu, South Korea
Research Intern (Advisor: Prof. Chang-Sung Moon) — *Jun. 2020 – Feb. 2021*
Research on algorithm development for silicon detectors

Publications

Aging test of atomic vapor cell with Al_2O_3 wall coating on cubic glass
Applied Optics **64**, 7932-7937 (2025)
H. Kim, T. Jeong, S. H. Hong, J. B. Nam, S. Lee, Y. Lim, and S. H. Yim

Conferences

Towards the SERF regime in an atomic magnetometer
Korean Physical Society (KPS) Fall Meeting (2025)
H. Kim, Y. Lim, S. Lee, S. H. Hong, S. H. Yim, T. Jeong, and J. B. Nam

Lifetime extension of Rubidium vapor cells by Al_2O_3 coating
APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting (2025)
H. Kim, T. Jeong, S. Lee, and S. H. Yim

Demonstration of atom spin gyroscope operating with high bandwidth over 100 Hz
APS Division of Atomic, Molecular and Optical Physics (DAMOP) Meeting (2025)
S. H. Yim, S. Lee, T. Jeong, J. B. Nam, D. Kim, S. H. Hong, and H. Kim

Linear absorption spectroscopy in rubidium vapor cells: Applications in buffer gas measurement and lifetime estimation
Korean Physical Society (KPS) Spring Meeting (2025)
H. Kim, T. Jeong, S. Lee, J. B. Nam, S. H. Hong, and S. H. Yim

Honors and Awards

Physics Alumni Association Award and Scholarship (Outstanding Graduate) *Feb. 2024*
Awarded by the chair of the Physics Alumni Association, Kyungpook National University

Agency for Defense Development Director General's Award *Dec. 2023*
2nd prize at the MiliTECH Challenge hosted by the KAIST

Korea Military Academy President's Award *Dec. 2022*
2nd prize at the MiliTECH Challenge hosted by the KAIST

3rd prize of Academic Conference *Dec. 2021*
Awarded by the College of Natural Sciences, Kyungpook National University

Dean's list: 3 semesters (2021-1, 2021-2, 2022-2) *Nov. 2021, Apr. 2022, Apr. 2023*
Awarded by the College of Natural Sciences, Kyungpook National University

Grants and Scholarships

National Science and Technology Scholarship *Mar. 2022 – Feb. 2024*
Awarded by the Korea Student Aid Foundation (KOSAF)

Academic Encouragement Scholarship (Hyoseok Scholarship) *Apr. 2022*
Awarded by the Kyungpook National University Alumni Association
Outstanding students selected from each college (Representative of the College of the Natural Sciences)

Academic Achievement Scholarship *Aug. 2020, Feb. 2021, Aug. 2021*
Awarded by Kyungpook National University
A partial tuition reduction granted for academic excellence

Teaching Experiences

Undergraduate Tutoring in Classical Mechanics2 (PHYS212) Courses *Sep. 2023 – Dec. 2023*
Teaching Assistant

Undergraduate Tutoring in Electromagnetism2 (PHYS312) Courses *Mar. 2023 – Jun. 2023*
Teaching Assistant

Patents and Software

Buffer Gas Pressure Estimation for OPAMs *Dec. 2024*
Registered in Korea Copyright Commission (C-2024-047156)

Rubidium Vapor Cell Lifetime Monitoring and Analysis Tool *Dec. 2024*
Registered in Korea Copyright Commission (C-2024-054414)

Other Experiences

Research Officer for National Defense (ROND) *Jun. 2024 – May. 2027*

Selected top students (2 per year in Physics) for a program modeled after Israel's Talpiot, completing mandatory military service through research at the Agency for Defense Development, Korea's DARPA counterpart.

Concurrently serving as a First Lieutenant in the Republic of Korea Air Force.

Tutoring for International Undergraduate Freshmen *Feb. 2022 – May. 2022*

Mentored for 2 hours per week on general academic life and basic calculus
Selected as an excellent tutor

Skills

- Programming: Python (NumPy, SciPy, SymPy, pandas, matplotlib), Wolfram Language (Mathematica)
- Software: LabVIEW, Solidworks