Junhee **Cho**

Graduate Researcher in Quantum Computing and Semiconductor Devices

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Education

POSTECH(Pohang University of Science and Technology) — *Pohang, Korea*

M.S. in Electrical Engineering — *Mar. 2023 - Present*

- GPA: 4.25 / 4.3
- Supervisor: Prof. Moonjoo Lee
- Thesis: Construction of a Cryogenic Ion-Trap Quantum Computing System and Investigation of Light-Induced Charging Effects from Electrode Patches

Hongik University — *Seoul, Korea*

B.S. in Electronic and Electrical Engineering — *Mar. 2016 - Feb. 2023*

- GPA: 3.96 / 4.5
- Supervisor: Prof. Ho-Young Cha

Skills

Data Analysis & Machine Learning	Python, C, Matlab, PyTorch
Device Design and Simulation	TCAD (Silvaco Atlas & Athena), SPICE (BSIM4, LTspice, Pspice), MATLAB, Microwind3 HFSS (Ansys electronics)
Vacuum Systems	Pumping system (rotary pump, turbo pump, ion pump and NEG pump), Ti sublimation, Ion gauge
Laser / Fiber Optics	Frequency lock, SM-fiber delivery, double-pass AOM modulation, PID power lock
Material Analysis and Imaging	SEM & EDS, 3D Profiler, SIMS, XRD
Quantum Simulation	QUTIP, Qiskit
Control & Embedded Systems	PyQt (Experimental GUI), FPGA, High-resolution DAC, Arduino, Raspberry Pi
3D modeling	Autocad inventor, Rhino 8

Research Experiences

Master's candidate — *Pohang, Korea*

POSTECH Quantum Computing and Quantum Networks Lab. — *Mar. 2023 - Present*

Outline: Construction of cryogenic ion trap system for quantum computing

- Investigated on nonlinear Duffing oscillator dynamics of $^{174}Yb^{+}$ ion motion
- Designed and fabricated a multi-layer ion trap chip to implement a quantum computing platform
- Constructed an ultra-high vacuum (UHV) and electrical delivery system within a cryogenic station
- Implemented a 4 K cryogenic UHV system with EMCCD imaging, achieving successful detection of $^{40}Ca^{+}$ ion fluorescence
- Designed and built a stable laser system and optical path for trapped-ion manipulation
- Developed a PyQt-based user interface(UI) to automate the experimental setup
- Trapped two $^{40}Ca^{+}$ ion qubits and compensated micro-motion by reducing the Lorentzian linewidth in 397 nm spectroscopy
- Investigating how light-induced charging from oxide patches on trap electrodes distorts the trapping potential and drives ion-position drifts through a surface photovoltage (SPV)-based analysis (manuscript in preparation)
- Developing a real-time ion tracking program that employs a CNN model (Faster R-CNN) to automatically identify ion count and positions from EMCCD images (patent application in progress)

Undergraduate student — *Seoul, Korea*

Hongik Univ. Advanced Semiconductor Technology Lab. — *Aug. 2021 - Dec. 2022*

Outline: Enhancement-mode operation of depletion-mode GaN HEMT by integrating with clamp circuit

- Modeled and analyzed AlGaN/GaN HEMT using TCAD(Silvaco Atlas)
- Converted TCAD model to Spice model by BSIM3 library
- Implemented a clamp circuit in LTspice to achieve normally-off operation and optimized switching speed
- Achieved high power conversion efficiency in a DC-DC boost converter

Selected Conferences

A Segmented-blade Trap and Oscillatory Motion of Trapped Ions — *Okinawa, Japan*

Myunghun Kim, **Junhee Cho**, Sangsoo Han, Sehyeon Gwon, Hyegoo Lee, Keumhyun Kim and Moonjoo Lee — *Sep. 2024*

Advanced Quantum Technologies for Trapped Ions (AQTTI), Poster presentation

Constructing Ytterbium Ion Trap System for Quantum Computing using Cryostat — *Gyeongju, Korea*

Junhee Cho, Myunghun Kim, Sehyeon Gwon, Keumhyun Kim, Hyegoo Lee, Sangsoo Han and Moonjoo Lee — *Feb. 2024*

31^{st} Korean conference on semiconductors (KCS), Poster presentation

A segmented-blade trap with biasing rods *Hannover, Germany*

Myunghun Kim, **Junhee Cho**, Keumhyun Kim, Hyegoo Lee, Jungsoo Hong and Moonjoo Lee *Sep. 2023*

7^{th} European conference on trapped-ion(ECTI), Poster presentation

Enhancement-mode GaN MOS-HFET with Integrated Clamp Circuit *Jeongseon, Korea*

Junhee Cho, Seungheon Shin and Ho-Young Cha *Feb. 2023*

30^{th} Korean conference on semiconductors (KCS), Poster presentation

Publications

- **Junhee Cho**, Sangsoo Han, Keumhyun Kim, Hyegoo Lee, Yongha Shin, Myunghun Kim, Moonjoo Lee, "Light-Induced Charging and Photovoltage Quenching Dynamics Mediated by Surface Photovoltage in Oxide Patches on Trap Electrodes", *On preparation*
- Seongchan Bae, Myunghun Kim, **Junhee Cho**, Moonjoo Lee, Jae-Yoon Sim, "A 600-V Peak-to-Peak 65-dBc RF Signal Source for Trapped-Ion Quantum Computing", *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS II*, (2024)

Patents

Real-time trapped ion quantization system based on convolutional neural networks

Moonjoo Lee, Junhee Cho, Yongha Shin *On preparation*

Heat engine device using a single ion

Moonjoo Lee, Myunghun Kim, Junhee Cho *Oct. 2023*

- Korea, 10-2024-0006403 (2023)
- USA, 18/744,460 (P202)

Honors & Awards

Domestic Awards

Feb. 2023 **On-site Poster Award**, The 30^{th} Korean Conference on Semiconductors *Jeongseon, Korea*

Feb. 2024 **On-site Poster Award**, The 31^{st} Korean Conference on Semiconductors *Gyeongju, Korea*

Nov. 2024 **POSTECH Presidential Award**, POSTECH Startup Competition *Pohang, Korea*