Chihyo Ahn (Mark)

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Research Interests: Front-end Compiler, GPGPU Architecture, Design Space Exploration, Hardware-Software Co-optimization

Education

Georgia Institute of Technology — Sep. 2021 - Present
Ph.D. Student — Atlanta, GA

- Ph.D. student in Electrical and Computer Engineering
- Kwanjung Overseas Scholarship

University of Michigan Ann Arbor | *GPA 4.0/4.0* — Sep. 2018 - Aug. 2020
Master Student — Ann Arbor, MI

- Master of Science in Electrical and Computer Engineering

Sungkyunkwan University | *GPA 4.47/4.5* — Mar. 2011 - Aug. 2018
Undergraduate Student — Seoul, Korea

- Bachelor of Science in Electronic and Electrical Engineering / Business Administration **(Valedictorian)**

Queen's University Belfast — Jan. 2015 - Feb. 2016
Exchange Student — Belfast, United Kingdom

- Continued studying in Electrical Engineering / Business Administration (took 7 courses)

Research Experiences

HPArch Lab: Georgia Institute of Technology — Nov. 2021 - Present
Graduate Research Assistant (Advisor: Professor Hyesoon Kim) — Atlanta, GA

- Expanding the software stack:
  - Auto-tuned and expanded the RISC-V GPGPU configuration for diverse applications using analytical models.
  - Worked on a Host/Device LLVM IR translator for CUDA execution in configurable RISC-V GPGPU systems.
  - Improved performance using CUDA Graph and other kernel optimization to enhance computational efficiency.
- Efficient Deep Neural Network Framework for object detection:
  - Designed quantized training methods optimized for hardware-limited scenarios.
  - Designed schemes to select the most suitable pre-trained models for various datasets and target agents.

Solid State Electronics Lab: University of Michigan — May. 2020 - Apr. 2021
Research Intern (Advisor: Professor Robert Dick) — Ann Arbor, MI

- Addressed memory-hard problems involving unpredictable communication between processing elements and memory.
- Utilized Pymeep FDTD simulations to design free-space demultiplexers with superimposed Bragg gratings.
- Designed a multi-channel demultiplexer using FDFD/FDTD inverse design techniques, creating a fabricable free-space structure demultiplexer for use in global communication network architectures.

Quantum Science Theory Lab: University of Michigan Sep. 2018 - Apr. 2020

Graduate Student Research Assistant (Advisor: Professor Mackillo Kira) Ann Arbor, MI

- Worked on Fortran-based programs to compute the dynamics of microscopic material quantities using Semiconductor Bloch Equations (SBEs).
- Investigated full doublet contribution (scattering matrix) and excitation-induced dephasing models in SBEs to efficiently describe realistic quantum systems.

Nanofabrication Lab: University of Michigan Sep. 2018 - Apr. 2020

Graduate Student Research Assistant (Advisor: Professor Zetian Mi) Ann Arbor, MI

- Optimized nanowire and epilayer growth using Molecular Beam Epitaxy (MBE) for optoelectronic devices.
- Characterized optoelectronic properties of spontaneous nanowires embedded with GaN monolayers for deep-UV LEDs grown in MBE systems.
- Studied selective area growth for LEDs and laser devices with higher efficiency and selectivity using E-Beam lithography and MBE.

Display Devices and Materials Lab: SungKyunKwan University Sep. 2016 - Aug. 2018

Research Intern (Advisor: Professor Jangkun Song) Suwon, Korea

- Conducted experiments measuring the Kerr effect in 2D materials with high Kerr coefficients for optical applications.
- Characterized optical properties of α-ZrP by synthesizing, exfoliating, and measuring under various conditions for future birefringence-based displays.

Publications

C. Ahn, S. Jeong, L. P. Cooper, R. Han, H. Pu, N. Parnenzini, J. Zhao, B. Tine, H. Kim, "FastTrackGPU: Optimizing Softcore GPUs Through Thread Collapsing and Analytical Models", *IPDPS 2025 (2025)*. [under review]

S. Jeong, L. Cooper, J. Lee, H. Choi, N. Parnenzini, **C. Ahn**, Y. Lee, H. Kim, H. Kim, "SparseWeaver: Converting Sparse Operations as Dense Operations on GPUs for Graph Workloads", *HPCA 2025 (2025).*

C. Ahn, S. Jeong, L. P. Cooper, N. Parnenzini, H. Kim, "Comparative Analysis of Executing GPU Applications on FPGA: HLS vs. Soft GPU Approaches", *IPDPS Workshop 2024(CGRA4HPC) (2024).* [pdf]

Y. Wu, D. A. Laleyan, Z. Deng, **C. Ahn,** A. F. Aiello, A. Pandey, X. Liu, P. Wang, K. Sun, E. Ahmadi, Y. Sun, M. Kira, P. K. Bhattacharya, E. Kioupakis, Z. Mi, "Controlling defect formation of nanoscale AlN: Toward efficient current conduction of ultrawide-bandgap semiconductors", *Adv. Electron. Mater. 6, 2000337 (2020).* [pdf]

Y. Wu, X. Liu, P. Wang, D. A. Laleyan, K. Sun, Y. Sun, **C. Ahn,** M. Kira, E. Kioupakis, Z. Mi, "Monolayer GaN excitonic deep ultraviolet light emitting diodes", *Appl. Phys. Lett. 116, 013101 (2020).* [pdf]

C. H. Ahn, A. R. Masud, S. H. Hong, T. Z. Shen, J. K. Song, "Particle size dependence of electro-optical switching in ZrP nano colloid", *Liquid Crystals, 46:2, 159-165 (2018).* [pdf]

A. R. Masud, S. H. Hong, T. Z. Shen, **C. H. Ahn**, J. K. Song, "Electrical switching of birefringence in zirconium phosphate colloids with various solvents", *Opt. Express 26(1), 173–178 (2018).* [pdf]

Work Experiences

Lawrence Livermore National Lab: Center for Applied Scientific Computing May. 2024 - Aug. 2024

Computing Graduate Student Intern Livermore, CA

- Sparse / Quantization of object detection models for edge devices.

Samsung Austin Research Center: Compiler Team May. 2023 - Aug. 2023

Research and Development Intern Austin, TX

- Developed checker for invalid control flow during derivative calculation in GPU.
- Designed an optimizer for redundant thread mask update instructions.

Presentations

B. Tine, J. Young, S. Na, J. Lee, L. Cooper, **C. Ahn**, H. Kim, "Open-source RISC-V Based GPGPU (Vortex) and their usage cases", *Workshop, MICRO57,* (2024), Austin, TX, USA.

B. Tine, J. Young, L. Cooper, **C. Ahn**, S. Jeong, H. Kim, "Open-source RISC-V Based GPGPU (Vortex) and their usage cases", *Workshop, MICRO56,* (2023), Toronto, ON, Canada.

C. Ahn, Z. Mi, M. Kira, "Excitation-induced effects in semiconductors", *oral presentation, Bluesky Workshop,* (2019), Ann Arbor, MI, USA.

C. Ahn, K. Lee, J. Jian, W. Wu, Q. Wen, W. Jiang, R.A.Muniz, M. Kira, "Dynamic Cluster Expansion", *poster presentation, Quantum Science and Technology Workshop*, *(2019),* Ann Arbor, MI, USA.

C. H. Ahn, A. R. Masud, J. K. Song, "Electro-Optical Switching of α-ZrP", *International Meeting on Information Display 2017, (2017)*, Busan, Korea.

Skills

Relevant Courses

- High Performance Computer Architecture, Interconnection Networks, Adv Programming Techniques
- Machine Learning, Computer Vision

Technical Skills

- **Computer Programming:** Fortran, Python, PyTorch, PyMeep, C++, LLVM, MATLAB, LaTeX, Excel VBA
- **Device Characterization:** Scanning electron microscopy (SEM), Energy dispersive spectrometer (EDS), E-beam Lithography (EBL), Temperature dependent Photoluminescence (PL)
- **Thin Film Epitaxy:** Molecular Beam Epitaxy (MBE)

Honors and Awards

Kwanjung Overseas External Scholarship: $20,000/year towards Ph.D. Degree
- **Kwanjung Educational Foundation** — 4 years

University of Michigan Program Entry Award: Full Academic Graduate Scholarship
- University of Michigan Ann Arbor — 2 years

National Scholarship for Science and Engineering: Full Academic Undergraduate Scholarship
- The Korea Student Aid Foundation — 8 terms

Prize in Graduation Thesis Competition: 2nd place
- Sungkyunkwan University — 2018

Graduation Awards: graduated **first in class**
- Sungkyunkwan University — 2018

Dean's list
- Sungkyunkwan University — 5 terms

Academic Excellence Prize: **first ranked** student in engineering department ($1000)
- Sungkyunkwan University — 2012

Internship Program Scholarships ($500)
- Leaders in Industry-University Cooperation Sungkyunkwan University — 2015

Extracurricular Activities

Gaya Global: Trade Company Jun. 2015 - Aug. 2015
Research and Development Intern Seoul, Korea

- Developed prototypes for calculating total revenue and expenses.
- Designed automated system for documenting invoice and packing list.
- Dealt with technical and communication issues.

Republic of Korea Army: 131 Engineering Battalion May 2012 - Jan. 2014
Radio Operator Yeoncheon, Korea

- Served 21 months, honorably discharged as a sergeant.
- Engaged in landmine detection removal operations at Demilitarized Zone, Korea.

Sullivan Center for the Blind Nov. 2014 - Jan. 2016
Volunteer Seoul, Korea

- Converted books into braille for the blind.

Teaching Experiences

ECE 2031: Digital Design Laboratory FA21 *(TA, GATech)* Aug. 2021 - Dec. 2021

- Assisted students in understanding the implementation of digital during lab sessions and office hours.

EECS 215: Introduction to Electronic Circuits WN20 (*TA, Umich*) Jan. 2020 - Apr. 2020

- Assisted students in understanding circuit properties and conducting experiments during lab sessions and office hours.

Sungkyunkwan University International Summer Semester *(TA)* Jun. - Jul. 2016 / Jun. - Jul. 2018

- Assisted with two business courses covering: daily classes, office hours, course plan build-up.
- Aided foreign exchange students with adjusting to campus life and Korean culture through various activities including welcoming orientation and field trips.