

# Sunjae Lee

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## RESEARCH INTERESTS

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My research interests are driven to contribute to a **Commercially viable magnetic confinement fusion**. Especially, 1) MHD stability in **negative triangularity** and 2) development of **AI-based high-performance simulations**.

## EDUCATION

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**Seoul National University**  
College of Liberal Studies

Mar 2021 – Feb 2026 (Expected)  
Seoul, Korea

- B.S., in both Computer Science and Engineering, Physics

## RESEARCH EXPERIENCES

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**Dept. of Nuclear Engineering, Seoul National University**  
Undergraduate Research Intern → incoming M.S. Student

Sep 2024 – Present  
Seoul, Korea

**3 Dimensional Stellarator & Tokamak Lab - Advisor: Prof. Jong-Kyu Park**

- Conducted stability analysis of NT using ideal, drift-kinetic, and kinetic MHD models with DCON
- Discovered DIII-D's NT a second stability region in  $n = 1$  kink mode and analyzed shear effect
- Simulated edge ballooning mode around the second stability region using kineticEFIT and BALOO

**Princeton Plasma Physics Laboratory (PPPL)**  
Visiting Research Student, SNU-PPPL Summer Collaboration

Jul 2025 – Aug 2025  
Princeton, NJ, USA

- Participated in PPPL-SNU Summer Research Collaboration with intended focus on nonlinear 3D MHD modeling, transport analysis, and pilot plant design for NSTX-U and KSTAR plasmas
- Learning and applying BALOO code for edge stability analysis in K-DEMO project and NT plasmas

**Dept. of Nuclear Engineering, Seoul National University**  
Undergraduate Research Intern, NUPLEX Lab

Sep 2023 – Aug 2024  
Seoul, Korea

**Seoul National University Plasma & Ion Beam Laboratory - Advisor: Prof. Y. S. Hwang**

- Designed and implemented a database for the VEST using the IMAS-HSDS data architecture
- Developed a Python-based post-processing tool (VAFT) for automated analysis of experimental shot data
- Explored operational space for the first, identifying performance limits from current-driven instabilities

## PUBLICATIONS

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J: Journal, R: Under Review, C: Conference

- [J.1] Hong-Sik Yun<sup>†</sup>, **Sunjae Lee<sup>†</sup>**, Laurent Jung, et al. (2025). **Developing an IMAS-Compatible Platform for the University-Level Tokamak VEST and Its Application in Operating Characteristics Analysis**. *Plasma Physics and Controlled Fusion*, Vol. 00, Issue 0, pp. 000-000. DOI: 00.0000/000000.0000.000000

<sup>†</sup> These authors contributed equally to this work.

## ORALS & POSTERS

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P: Poster prese, O: Oral presentations

- [P.1] **S. J. Lee**, J. B. Cho, O. Nelson, C. Paz-Soldan, J.-K. Park. (2025). **Kinetic MHD Stability of Low-n Modes in Negative Triangularity Plasmas**. *67th Annual Meeting of the APS Division of Plasma Physics*, Long Beach, CA, USA (Nov 2025 - Planned)

- [P.2] **S. J. Lee, J. B. Cho, O. Nelson, C. Paz-Soldan, J.-K. Park. (2025). Kinetic stability of negative-triangularity plasmas.** *29th Workshop on MHD Stability Control*, Princeton, New Jersey, USA (Jul 2025)
- [P.3] **S. J. Lee, J.-K. Park, H.S. Yun, L. Jung, G. W. Nam, G. G. Seo, J. M. Lee (2025). Standardized Data Infrastructure for Tokamak: Implementation in VEST (Versatile Experiment spherical tokamak).** *2025 Spring meeting of the Korean Physics Society*, Seoul, Korea (Apr 2025)
- [P.4] **S. J. Lee, H.S. Yun, Laurent Jung, Jung-Hwa Kim, Y.S. Hwang (2024). Improvements of database system and analysis suite in VEST.** *3rd International Fusion and Plasma conference (IFPC)*, Seoul, Korea (Jun 2024)

## PROJECTS & AWARDS

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### Perturbed Equilibrium Code Hackathon – Columbia Fusion Research Center

Jul 2025

Tools: Julia, Fortran, GPEC (reference), Plasma Physics Modeling

Columbia, NY, USA [🌐]

- Participated in a hackathon to reproduce DCON's energy-principle-based ideal MHD stability solver in Julia
- Developed coordinate transformation and numerical routines to compute mode stability from tokamak equilibrium

### High-Performance CUDA Programming Project – Accelerator Programming Summer School

Jun 2024

Tools: CUDA, NVIDIA GPU, Nsight, C++

- Built parallel programs using CUDA and C++, applying GPU programming for high-throughput computation
- Analyzed performance using Nsight Systems, identifying bottlenecks in memory access and execution flow
- Learned to design compute-intensive GPU algorithms and understand CPU–GPU workload division

### Text-to-Image Generation with Conditional GAN, 2023 OUTTA Deep Learning Bootcamp

Jun 2023 – Aug 2023

Tools: PyTorch, Conditional GAN, Google Colab

2nd Prize Winner

- Built a text-to-image generation model using conditional GAN architecture and Ranked 2 out of 60 teams

## TEACHING EXPERIENCE

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Teaching Assistant, Computer Architecture — Seoul National University

Fall 2025

## VOLUNTEER EXPERIENCE

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Home Renovation Volunteer, Habitat for Humanity Korea ([Snuhabitat](#))

Sep 2021 – Feb 2022

Animal Shelter Volunteer, Tail – SNU ([@tail\\_snu](#))

Mar 2022 – Aug 2023

## SKILLS & ADDITIONAL INFORMATIONS

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- **Programming Languages:** Python, C/C++, Fortran, Julia, Java, Linux, CUDA, MATLAB, OpenCL, MPI/OpenMP
- **Simulation Tools:** DCON, GPEC, BALOO, KineticEFITtime
- **TOEFL iBT MyBestScore:** 105/120 (Reading 27, Listening 28, Speaking 27, Writing 23)
- **Relevant Coursework** Fusion Plasma Theory(Graduate), Introduction to Nuclear Fusion, Electricity and Magnetism, Thermal and Statistical Physics, Scalable High-Performance Computing(Graduate), Introduction to Numerical Analysis, Introduction to Machine Learning, Introduction to Deep Learning,