

# Jiwon Lee

Ph.D. Student · JSPS Research Fellow (DC1)

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## SUMMARY

Ph.D. student and JSPS Research Fellow (DC1) in Aeronautics & Astronautics at the University of Tokyo, specializing in **electric propulsion** and **rarefied gas dynamics**. I bridge in-house **DSMC simulation** and **thruster experiments** to improve argon Hall thrusters, with **4 peer-reviewed journal articles** and **21 conference presentations** (12 first-author). Broad interests span gas–surface interaction modeling and air-breathing electric propulsion (ABEP) for future low-Earth-orbit and deep-space missions.

## RESEARCH INTERESTS

Electric propulsion; Hall thrusters; alternative propellants; air-breathing electric propulsion (ABEP); rarefied gas dynamics; Direct Simulation Monte Carlo (DSMC); gas–surface interaction modeling; TAL-type Hall thrusters; swirl injection; sawtooth anode.

## EDUCATION

### The University of Tokyo

*Ph.D. in Aeronautics and Astronautics* · Advisor: Prof. Kimiya Komurasaki

Oct. 2025 – Present

Tokyo, Japan

### The University of Tokyo

*M.S. in Aeronautics and Astronautics* · Advisor: Prof. Kimiya Komurasaki

Oct. 2023 – Sep. 2025

Tokyo, Japan

Thesis: “Anode Design Optimization of Argon Hall Thrusters Based on DSMC Analysis of Neutral Particle Behavior”

### The University of Tokyo

*Research Student, Aeronautics and Astronautics* · Advisor: Prof. Kimiya Komurasaki

Mar. 2023 – Sep. 2023

Tokyo, Japan

### Hanyang University

*B.S. in Mechanical Engineering* · Advisor: Prof. Rhokyun Kwak · incl. 18-month military service

Mar. 2017 – Feb. 2023

Seoul, Korea

Thesis: “Electroconvective instability on liquid metal electrodes”

## RESEARCH EXPERIENCE

### Doctoral & Master’s Research

*Komurasaki & Koizumi Laboratory, The University of Tokyo* · Advisor: Prof. Kimiya Komurasaki

Oct. 2023 – Present

- Developed an in-house **DSMC code** to characterize rarefied neutral-gas dynamics inside the discharge channel of argon Hall thrusters.
- Showed that **swirl injection** and a **sawtooth hollow anode** enhance reverse flow, raising channel neutral density; validated experimentally on the **RAIJIN-66** thruster.
- Currently formulating a **Sawtooth–CLL gas–surface interaction model** in DSMC for anode design optimization.

**Research Internship** — Complex Micro-Fluids Lab, KIST  
*Korea Institute of Science and Technology, Republic of Korea*

Aug. 2022 – Sep. 2022

- Measured fluorescent-particle velocity fields in microchannels by Particle Streak Velocimetry.

## PUBLICATIONS (PEER-REVIEWED JOURNAL ARTICLES)

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Underlined = first author; **J. Lee** = author.

4. N. Barth, K. Komurasaki, D. Satpathy, **J. Lee**, et al., "Magnetohydrodynamic Analysis of Acceleration Length and Magnetic Field Optimization in an Argon Hall Thruster," *Journal of Applied Physics*. [Under Review]
3. D. Satpathy, K. Komurasaki, **J. Lee**, et al., "Impact of reverse flow induced by a sawtooth anode on the performance of an argon Hall thruster," *Journal of Applied Physics*, 2026. doi:10.1063/5.0307266
2. **J. Lee**, et al., "Numerical Analysis of Rarefied Gas Flow Dominated by Wall Reflection in a Straight Channel," *Vacuum*, 2026. doi:10.1016/j.vacuum.2025.114930
1. D. Satpathy, H. Sekine, **J. Lee**, et al., "Influence of propellant injection directionality on the performance of an argon Hall thruster," *Journal of Applied Physics*, 2024. doi:10.1063/5.0241386

## CONFERENCE PRESENTATIONS — INTERNATIONAL

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11. **J. Lee**, et al., "Modeling of Sawtooth-Shaped Walls for Rarefied Gas Flow Control," *34th International Symposium on Rarefied Gas Dynamics*, Brisbane, Australia, Jul. 2026. (Oral)
10. **J. Lee**, et al., "Sawtooth-Shaped Wall Reflection Model for Argon Hall Thruster," *33rd Annual Meeting of the Institute of Applied Plasma Science*, Shizuoka, Japan, Mar. 2026. (Oral)
9. **J. Lee**, et al., "Numerical Analysis for the Design Optimization of Sawtooth-Shaped Channels for Enhanced Reverse Flow," *78th Annual Gaseous Electronics Conference*, Seoul, Republic of Korea, Oct. 2025. (Oral)
8. **J. Lee**, et al., "Control of Neutral Gas Flow in a Hollow Anode of Hall Thrusters," *39th International Electric Propulsion Conference*, London, UK, Sep. 2025. (Poster)
7. D. Satpathy, H. Sekine, **J. Lee**, et al., "Enhancement of neutral particle density by propellant reversal through a sawtooth hollow anode," *39th International Electric Propulsion Conference*, London, UK, Sep. 2025. (Oral)
6. D. Satpathy, H. Sekine, **J. Lee**, et al., "Difference in plasma potential profiles between xenon and argon propellants in RAIJIN-66," *39th International Electric Propulsion Conference*, London, UK, Sep. 2025. (Oral)
5. N. Barth, D. Satpathy, **J. Lee**, et al., "Magnetohydrodynamic Analysis of High-Density Plasma Hall Thruster Operation," *39th International Electric Propulsion Conference*, London, UK, Sep. 2025. (Oral)
4. **J. Lee**, et al., "Neutral Gas Flow Dynamics in a Hall Thruster Dominated by Wall Reflections," *35th International Symposium on Space Technology and Science*, Tokushima, Japan, Jul. 2025. (Oral)
3. D. Satpathy, H. Sekine, **J. Lee**, et al., "An argon Hall thruster using a hollow anode with corrugated surface," *35th International Symposium on Space Technology and Science*, Tokushima, Japan, Jul. 2025. (Oral)
2. N. Barth, T. Suehiro, D. Satpathy, **J. Lee**, et al., "Magnetohydrodynamic Analysis of High Mass Flow Rate-Induced High-Density Plasma Hall Thruster Operation," *12th Asian Joint Propulsion Conference*, Xi'an, China, Mar. 2025. (Oral)
1. D. Satpathy, H. Sekine, **J. Lee**, et al., "Propellant Utilization Efficiency of an Argon Hall Thruster with Swirl Injection," *38th International Electric Propulsion Conference*, Toulouse, France, Jun. 2024. (Oral)

## CONFERENCE PRESENTATIONS — DOMESTIC (JAPAN)

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10. **J. Lee**, et al., "Numerical Implementation of the Sawtooth-CLL Boundary Model in DSMC for Rarefied Gas Flow Control," 第 58 回流力講演会／第 44 回 ANSS, Tottori, Japan, Jun. 2026. (Oral)

9. **J. Lee**, et al., "Analysis of Neutral Particle Back-flow Effects on Sawtooth Walls in TAL," 令和 7 年度宇宙輸送シンポジウム, Kanagawa, Japan, Jan. 2026. (Oral)
8. N. Barth, D. Satpathy, K. Komurasaki, **J. Lee**, et al., "The Role of the Hall Parameter in Magnetohydrodynamic Scaling of Hall Thrusters," 令和 7 年度宇宙輸送シンポジウム, Kanagawa, Japan, Jan. 2026. (Oral)
7. **J. Lee**, et al., "Analysis of Neutral Particle Flow Variation in the Anode and Channel According to Injection Methods," 令和 6 年度宇宙輸送シンポジウム, Kanagawa, Japan, Jan. 2025. (Oral)
6. **J. Lee**, et al., "Rarefied Gas Flow in a Channel Dominated by Wall Reflection," 第 38 回数値流体力学シンポジウム, Tokyo, Japan, Dec. 2024. (Oral)
5. **J. Lee**, et al., "DSMC Numerical Analysis of Suitable Anode Length for Swirl Injection Method and Efficiency Change by Mass Flow Rate," 第 68 回宇宙科学技術連合講演会, Himeji, Japan, Nov. 2024. (Poster)
4. **J. Lee**, et al., "Rarefied Gas Dynamics of a Propellant Flow Spiraling in a Channel," 第 55 回日本航空宇宙学会年会講演会, Tokyo, Japan, Apr. 2024. (Oral)
3. D. Satpathy, **J. Lee**, et al., "Impact of active anode cooling on argon Hall thruster performance," 第 63 回航空原動機・宇宙推進講演会, Sapporo, Japan, Mar. 2024. (Oral)
2. D. Satpathy, H. Sekine, **J. Lee**, et al., "Ionization length estimation of RAIJIN-66 from performance measurements during thermal transient operation," 令和 5 年度宇宙輸送シンポジウム, Kanagawa, Japan, Jan. 2024. (Oral)
1. **J. Lee**, et al., "Use of Argon Propellant in a Hall Thruster for Mass Transportation," 第 9 回宇宙太陽光発電シンポジウム, Kanazawa, Japan, Dec. 2023. (Oral)

## HONORS & AWARDS

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- **JSPS Research Fellowship for Young Scientists (DC1)** — Japan Society for the Promotion of Science, Apr. 2026 – Mar. 2029 (selected Oct. 2025). Grant No. 26KJ0944; acceptance rate  $\approx 9\%$ .
- **LOTTE Foundation Scholarship** — Lotte Foundation, Oct. 2024 – Mar. 2026 (top student, Fall 2024 cohort).
- **Grand Prize, 2024 Aero Future & Business Idea Competition** — Hanwha Aerospace, Jul. 2024 (Top 3 of 126 teams, "Future Tech").
- **Third Prize, Capstone Design Competition** — School of Mechanical Engineering, Hanyang University, Jun. 2022 (top 10% of graduation theses).

## PROFESSIONAL EXPERIENCE

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### Auxilart Co., Ltd.

*CFD Engineer* · Computational modeling of gas–liquid two-phase flows in industrial tanks

**Apr. 2025 – Present**

Japan

## TECHNICAL SKILLS

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**Numerical methods:** DSMC (in-house code development), CFD (OpenFOAM, Ansys); scientific computing in C, C++, Fortran, Python, MATLAB.

**Experimental / tools:** LabVIEW, Particle Streak Velocimetry, ParaView, Autodesk Inventor.

**Languages:** Korean (Native), English (Fluent), Japanese (Fluent).

## ACTIVITIES & SERVICE

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- **54th President**, Korean Student Association, The University of Tokyo, Apr. 2026 – Mar. 2027.

- Completed **Deep Space Exploration Education Program**, The University of Tokyo, Mar. 2025.
- Completed **Computational Science Alliance Program**, The University of Tokyo, Mar. 2025.
- **Military Service**, Army Aviation Command, R.O.K. Army, Jul. 2020 – Jan. 2022 (Medium Utility Helicopter mechanic).
- **Student Council President**, Pungmu High School, Mar. 2016 – Feb. 2017.