

April, 2022

# YUSUKE YAMASHITA

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## BRIEF STATEMENT OF RESEARCH INTERESTS

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Topics Computational plasma physics; kinetic theory and kinetic particle simulation; simulation of microwave plasma sources (ion thrusters) and hall effect thrusters; high parallel computing; numerical scheme (implicit scheme, conservative scheme); plasma physics (anomalous transport, microwave and plasma interaction).

## EDUCATION

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March 2022 Doctor Engineering in Aeronautics and Astronautics, The University of Tokyo, Japan  
March 2019 Master Engineering in Aeronautics and Astronautics, The University of Tokyo, Japan  
March 2017 Bachelor Engineering in Aeronautics and Astronautics, Osaka Prefecture University, Japan

## EMPLOYMENT HISTORY

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April 2022 – Current Postdoctoral Researcher  
Plasma Dynamics Modeling Laboratory  
Aeronautics and Astronautics, Stanford Univeristy  
April 2019 – March 2022 JSPS Research Fellow DC2 (Ph.D. student course)  
Electric propulsion laboratory  
Department of Aeronautics and Astronautics, The University of Tokyo  
April 2018 - March 2019 Graduate Student Research Assistant  
Electric propulsion laboratory  
Department of Aeronautics and Astronautics, The University of Tokyo  
July 2017 - February 2018 Graduate Student Research Assistant  
Electric propulsion laboratory  
Institute of Space and Astronautical Science

## AWARDS AND HONORS

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March 2022 Japanese Rocket Society Award at 33rd International Symposium on Space Technology and Science  
August 2021 Second place award in student competition at International Electric Propulsion Conference  
March 2020 - Current Super computer user: KDK super computer system at the Research Institute for Sustainable Humanosphere, Kyoto University  
October 2019 Overseas Dispatch Assistance for international conference  
TEPCO Memorial Foundation

July 2018

Overseas Dispatch Assistance for international conference  
Murata Science Foundation

ABROAD EXPERIENCE

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March - August 2019      Development of full particle kinetic simulation of computational model for Hall effect thrusters  
Department of Aerospace Engineering, Texas A&M University

PUBLICATION AND PRESENTATIONS

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**Journal Articles**

1. **Y. Yamashita**, R. Tsukizaki, K. Nishiyama, "Investigation of plasma mode transition and hysteresis in electron cyclotron resonance ion thrusters", *Plasma Sources Sci. Technol.*, *accepted*, 2021 September, <https://doi.org/10.1088/1361-6595/ac243b>
2. **Y. Yamashita**, R. Tsukizaki, Y. Yamamoto, D. Koda, K. Nishiyama, and H. Kuninaka, "Azimuthal ion drift of a gridded ion thruster", *Plasma Sources Sci. Technol.*, **27**, pp.105006-1-9, 2018
3. **Y. Yamashita**, Y. Tani, R. Tsukizaki, D. Koda, and K. Nishiyama, "Numerical investigation of plasma properties for the microwave discharge ion thruster  $\mu 10$  using PIC MCC simulation", *Phys. Plasma*, **26**, pp. 073510-1-7, 2019
4. **Y. Yamashita**, R. Tsukizaki, K. Kinefuchi, D. Koda, and K. Nishiyama, "Neutral ground state particle density measurement of xenon plasma in microwave cathode by two-photon laser induced fluorescence spectroscopy", *Vacuum*, **168**, pp. 108846, 2019
5. **Y. Yamashita**, Y. Tani, R. Tsukizaki, D. Koda, and K. Nishiyama, "Characteristics of Plasma and Gas in Microwave Discharge Ion Thruster  $\mu 10$  Using Kinetic Particle Simulation", *Trans. JSASS Aerospace Tech. Japan*, **18**, pp. 57-63, 2020
6. **Y. Yamashita**, R. Tsukizaki, D. Koda, Y. Tani, R. Shirakawa, K. Hattori, and K. Nishiyama, "Plasma hysteresis caused by high-voltage breakdown in gridded microwave discharge ion thruster  $\mu 10$ ", *Acta Astronautica*, **185**, pp. 179-187, 2021
7. **Y. Yamashita**, Y. Tani, R. Tsukizaki, K. Kinefuchi and K. Nishiyama, "Effect of ion extraction for gridded ion thruster", *vacuum*, <https://doi.org/10.1016/j.vacuum.2022.110962>
8. **Y. Yamashita**, R. Tsukizaki, and K. Nishiyama, "Importance of stepwise ionization from the metastable state in electron cyclotron resonance ion thrusters", *invitation from journal of electric propulsion*
9. Y. Tani, **Y. Yamashita**, R. Tsukizaki, K. Nishiyama, and H. Kuninaka, "Effect of discharge chamber geometry on ion loss in microwave discharge ion thruster", *Acta Astronautica*, **176**, pp. 77-88, 2020
10. R. Shirakawa, **Y. Yamashita**, D. Koda, R. Tsukizaki, Y. Shimizu, M. Tagawa, and K. Nishiyama, "Investigation and experimental simulation of performance deterioration of microwave discharge ion thruster  $\mu 10$  during space operation", *Acta Astronautica*, **174**, pp. 367-376, 2020
11. R. Tsukizaki, **Y. Yamashita**, K. Kinefuchi, and K. Nishiyama, "Application of Two-photon Laser-induced Fluorescence Spectroscopy to Microwave Cathode", *Trans. JSASS Aerospace Tech. Japan*, **63**, No. 6, pp. 281-283, 2020
12. R. Tsukizaki, **Y. Yamashita**, K. Kinefuchi, and K. Nishiyama, "Neutral Atom Density Measurements of Xenon Plasma inside a  $\mu 10$  Microwave Ion Thruster using Two-photon Laser-induced Fluorescence Spectroscopy", *Vacuum*, **190**, 110269, 2021
13. R. Tsukizaki, **Y. Yamashita**, "Spectroscopic Measurements for Electric Thruster", *J. Plasma Fusion Res.* **96**, No.12, pp. 714-721, 2020
14. R. Tsukizaki, Y. Yamamoto, D. Koda, **Y. Yamashita**, K. Nishiyama, and H. Kuninaka, "Azimuthal velocity measurement in the ion thruster using laser-induced fluorescence spectroscopy," *Plasma Sources Sci. Technol.*, **27**, pp.015013-1-9, 2018
15. K. Shoda, N. Kano, Y. Jotaki, K. Ezaki, K. Itatani, T. Ozawa, **Y. Yamashita**, K. Nishiyama, K. Yokota and M. Tagawa, "Anisotropic molecular scattering at microstructured surface for rarefied gas compression inside air breathing ion engine", *CEAS Space Journal*, <https://doi.org/10.1007/s12567-022-00430-7>

### Journal Articles (under review, preparation)

1. **Y. Yamashita**, R. Tsukizaki, and K. Nishiyama, “Thruster performance related to plasma mode-transition and plasma hysteresis in microwave discharge ion thruster”, *transaction of JSASS*
2. **Y. Yamashita**, K. Hattori, R. Tsukizaki, and K. Nishiyama, “Importance of stepwise ionization from the metastable state in electron cyclotron resonance ion thrusters”, *transaction of JSASS*

### International Conferences

1. **Y. Yamashita**, R. Tsukizaki, Y. Yamamoto, D. Koda, K. Nishiyama, and H. Kuninaka, “2DPIC simulation and laser induced fluorescence spectroscopy of the roll torque of the gridded ion thruster”, The 54th Joint Propulsion Conference & Exhibit, 2018
2. **Y. Yamashita**, Y. Tani, R. Tsukizaki, D. Koda, and K. Nishiyama, “Plasma characteristics of microwave ion thrusters  $\mu 10$  using 2D PIC/MCC simulation”, The 32th International Symposium on Space Technology and Science, 2018
3. **Y. Yamashita**, Y. Tani, R. Tsukizaki, D. Koda, K. Nishiyama, and H. Kuninaka, “Numerical study of microwave discharge ion thruster”, The 36th International Electric Propulsion Conference, 2019
4. **Y. Yamashita**, C. Gonzalez, K. Hara, S. Cho, and K. Nishiyama, “Study of the electron anomalous transport in a Hall effect thruster using a 2D multi fluid simulation”, The 36th International Electric Propulsion Conference, 2019
5. **Y. Yamashita**, K. Koda, R. Tsukizaki, and K. Nishiyama, “Investigation of Hysteresis on propellant flow rate for 10 cm class microwave ion thruster”, *Space Propulsion 2020+1*, 2021
6. **Y. Yamashita**, R. Tsukizaki, K. Kinefuchi and K. Nishiyama, “Novel diagnostics of neutral density inside gridded ion thruster by using two-photon absorption LIF”, IEPC 2021 Student Competition Participants, 2021
7. **Y. Yamashita**, R. Tsukizaki and K. Nishiyama, “Thruster development and plasma diagnostics of microwave discharge ion thruster”, The 33th International Symposium on Space Technology and Science, 2021
8. R. Tsukizaki, **Y. Yamashita**, K. Kinefuchi, and K. Nishiyama, “Neutral density measurement of microwave cathode by two-photon absorption LIF”, The 36th International Electric Propulsion Conference, 2019
9. K. Hara, **Y. Yamashita**, S. Tsikata, B. Vincent, and S. Mazouffre, “New insights into electron transport due to azimuthal drift in a Hall effect thruster” The 36th International Electric Propulsion Conference, 2019
10. R. Tsukizaki, **Y. Yamashita**, K. Kinefuchi, and K. Nishiyama, “Neutral density measurement of microwave cathode by two photon laser induced fluorescence spectroscopy”, The 32th International Symposium on Space Technology and Science, 2019
11. A. Takasu, **Y. Yamashita**, N. Iwata, H. Yoshida, M. Isaka, Y. Tani, H. Nagai, K. Ueno, S. Hosoda, K. Nishiyama, and T. Muranaka, “Measurement of Plasma Plume Potential to Evaluate Backflow Energy of Ions Thruster”, The 32nd International Symposium on Space Science and Technology, 2019-b-095p, 2019
12. K. Hattori, **Y. Yamashita**, R. Tsukizaki and K. Nishiyama, “Experimental prediction of performance degradation during space operation in thrust-enhanced microwave discharge ion thruster  $\mu 10$ ”, The 33th International Symposium on Space Technology and Science, 2021
13. R. Tsukizaki, Y. Yamamoto, **Y. Yamashita**, and H. Kuninaka, “Azimuthal Velocity Measurement of  $\mu 10$  Microwave Ion Thruster by Laser Induced Fluorescence Spectroscopy”, The 35th International Electric Propulsion Conference, 2018
14. S. Cho, K. Hara, H. Watanabe, K. Kubota, and **Y. Yamashita**, “Investigation of cross-field electron transport in a 100-W class Hall Thruster using a full particle-in-cell simulation”, The 36th International Electric Propulsion Conference, 2019
15. K. Shoda, N. Kano, Y. Jotaki, K. Ezaki, K. Itatani, T. Ozawa, **Y. Yamashita**, K. Nishiyama, K. Yokota and M. Tagawa, 1st Int. Symp. VLEO mission and Technologies, “Molecular scattering at microstructured surface for rarefied gas compression inside air breathing ion engine”, 2021.
16. T. Kato, M. Shimoi, S. Taira, Y. Nakayama, T. Ozawa, **Y. Yamashita**, T. Abe, K. Yokota, M. Tagawa, 1st Int. Symp. VLEO mission and Technologies, “Atmospheric density probe for VLEO applications”, 2021
17. K. Shoda, K. Itatani, Y. Jotaki, Y. Ashida, K. Sugimoto, T. Ozawa, **Y. Yamashita**, K. Nishiyama, K. Yokota and M. Tagawa, 1st Int. Symp. VLEO mission and Technologies, “Scattering Behavior of Thermal Molecular Beams at Microstructured Surface for High Compression Intake System of Air Breathing Ion Engine”, The 33th International Symposium on Space Technology and Science, 2021

18. S. Taira, T. Kato, M. Shimoi, T. Adachi, T. Ushihjima, **Y. Yamashita**, T. Ozawa, T. Abe, Y. Nakayama, K. Kumiko, "Development of Atmospheric Density Probe aboard S-520-32 Sounding Rocket", The 33th International Symposium on Space Technology and Science, 2021

### Symposium

1. **Y. Yamashita**, R. Tsukizaki, Y. Yamamoto, D. Koda, K. Nishiyama, and H. Kuninaka, "Inside Ion Azimuthal Velocity Measurement of Microwave Discharge Ion Thruster by Laser-Induced Fluorescence Method" , The 61th Space Sciences and Technology Conference, 2017
2. **Y. Yamashita**, R. Tsukizaki, Y. Yamamoto, D. Koda, K. Nishiyama, and H. Kuninaka, "Ion azimuthal velocity of Microwave Discharge Ion Thruster" , Space Transportation Symposium FY2017, 2018
3. **Y. Yamashita**, Y. Tani, R. Tsukizaki, D. Koda, K. Nishiyama, and H. Kuninaka, "Numerical study on plasma in microwave discharge ion thruster using  $\mu 10$  using PIC simulation" , Space Transportation Symposium FY2018, 2019
4. **Y. Yamashita**, Y. Tani, R. Tsukizaki, D. Koda, K. Nishiyama, and H. Kuninaka, "Application of Two-photon Laser-induced Fluorescence Spectroscopy to Microwave Cathode" , Space Transportation Symposium FY2018, 2019
5. **Y. Yamashita**, R. Tsukizaki, K. Kinefuchi, D. Koda, Y. Tani, K. Nishiyama, and H. Kuninaka, "Spectroscopic measurement of Xe plasma using a high-power laser", The 62th Space Sciences and Technology Conference, 2018
6. **Y. Yamashita**, R. Tsukizaki, Y. Tani, D. Koda, K. Nishiyama, "Interaction between the plasma generation and the accelerating grid of the microwave ion thruster  $\mu 10$  focusing on the neutral particle density", The 63th Space Sciences and Technology Conference, 2019
7. **Y. Yamashita**, R. Tsukizaki, D. Koda, K. Nishiyama, "Ground state neutral density measurement of microwave ion thruster by using two-photon LIF" , Space Transportation Symposium FY2019, 2020
8. **Y. Yamashita**, R. Tsukizaki, K. Kinefuchi, and K. Nishiyama, "Internal neutral density measurement for microwave discharge ion thruster by using two-photon absorption laser-induced fluorescence spectroscopy" , Space Transportation Symposium FY2020, 2021
9. **Y. Yamashita**, "Development of energy conserving semi-implicit electromagnetic PIC simulation and application to space propulsion", STE Simulation Study Group / KDK Symposium Joint Study Group
10. R. Shirakawa, **Y. Yamashita**, Y. Shimizu, D. Koda, S. Hosoda, R. Tsukizaki, M. Tagawa, and K. Nishiyama, "Investigation and experimental simulation of in-space performance degradation of microwave discharge ion engine" , Space Transportation Symposium FY2019, 2020
11. K. Nishiyama, **Y. Yamashita**, R. Shirakawa, S. Hosoda, R. Tsukizaki, D. Koda, and S. Imai, Status of the Microwave Discharge Ion Engine's Conceptual Study for DESTINY<sup>+</sup>, The 63th Space Sciences and Technology Conference, 2019
12. R. Shirakawa, **Y. Yamashita**, Y. Miyake, H. Usui, M. Tagawa, N. Kano, and K. Nishiyama, "Feasibility study of Air Breathing Ion Engine by using plasma numerical analysis in discharge chamber", The 16th Spacecraft Environment Symposium, 2019
13. R. Shirakawa, **Y. Yamashita**, D. Koda, S. Hosoda, R. Tsukizaki, K. Nishiyama, and M. Tagawa, "Evaluation of performance deterioration due to contamination in microwave discharge ion engine  $\mu 10$ ", The 56th The Japan Society for Aeronautical and Space Sciences, Chubu Branch, 2019
14. K. Hattori, R. Shirakawa, **Y. Yamashita**, D. Koda, S. Hosoda, R. Tsukizaki, and K. Nishiyama, "Experimental simulation of performance deterioration during space operation for thrust-enhanced microwave discharge ion thruster", Space Transportation Symposium FY2020, 2021
15. Y. Tani, R. Tsukizaki, **Y. Yamashita**, K. Nishiyama, and H. Kuninaka, "Effect of Discharge Chamber Geometry on the ECR Ion Thruster Performance" , Space Transportation Symposium FY2018, 2019
16. T. Muranaka, A. Takasu, **Y. Yamashita**, N. Iwata, H. Yoshida, M. Isaka, Y. Tani, H. Nagai, K. Ueno, S. Hosoda, and K. Nishiyama, "Measurement of Plasma Plume Potential for a 10-cm-class Microwave-discharge-type Ion Thruster to Evaluate Energy of Backflow Ions", The 63th Space Sciences and Technology Conference, 2019

17. T. Muranaka, A. Takasu, **Y. Yamashita**, N. Iwata, H. Yoshida, M. Isaka, Y. Tani, H. Nagai, K. Ueno, S. Hosoda, and K. Nishiyama, “Measurement of Plasma Plume Potential for a 10-cm-class Microwave-discharge-type Ion Thruster”, The 36th The Japan Society of Plasma Science and Nuclear Fusion Research, 2019
18. H. Yoshida, M. Isaka, A. Takas, **Y. Yamashita**, N. Iwata, S. Hattori, K. Ueno, Y. Tani, S. Hosoda, and K. Nishiyama, “Effect of Neutralizer Electrons on Backflow Ions from 10-cm-class Microwave-discharge-type Ion Thrusters”, The 63th Space Sciences and Technology Conference, 2019
19. M. Shimoi, N. Kano, T. Kato, S. Hira, **Y. Yamashita**, T. Ozawa, S. Imamura, K. Yokota, and M. Tagawa, “Ionization Gauge for In-orbit Measurement of Molecular Density in sub-LEO (II)”, The 66th Space Sciences and Technology Conference, 2020
20. R. Shirakawa, H. Usui, Y. Miyake, M. Tagawa, **Y. Yamashita**, N. Kano, and K. Nishiyama, “Feasibility study of Air Breathing Ion Engine by using plasma numerical analysis in discharge chamber “, The 63th Space Sciences and Technology Conference, 2019
21. T. Muranaka, M. Isaka, T. Yoshida, S. Hattori, K. Ueno, **Y. Yamashita**, Y. Tani, S. Hosoda, and K. Nishiyama, “Evaluation of solar cell surface wear by measuring the amount of backflow ions in an ion propeller”, 2019 Symposium on Laboratory Experiment for Space Science, 2019
22. N. Kano, K. Shoda, J. Yuki, K. Yokota, M. Tagawa, T. Ozawa, **Y. Yamashita**, and K. Nishiyama, “Compression performance in Air Breathing Ion Engine and accommodation coefficient on the material surface”, 3F07, The 64th Space Sciences and Technology Conference, 2020
23. T. Muranaka, A. Takase, R. Shirakawa, T. Yoshida, N. Iwata, Y. Miya, **Y. Yamashita**, K. Ueno, S. Hosoda, and K. Nishiyama, “Measurement of Plasma Plume Potential for 10-cm-class Microwave-discharge Ion Thruster”, Space Transportation Symposium FY2019, 2020
24. K. Shoda, Y. Jotaki, K. Itatani, K. Ezaki, K. Sugimoto, Y. Ashida, T. Ozawa, **Y. Yamashita**, K. Nishiyama, K. Yokota and M. Tagawa, “A passive compression mechanism using molecular scattering at microstructured surface”, The 82 nd JSAP Autumn Meeting 2021

#### AFFILIATION

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- Student Member (2018-), American Institute of Aeronautics and Astronautics (AIAA)
- Student Member (2017-), The Japan Society for Aeronautical and Space Sciences (JSASS)