

Kenshiro Oguri

CONTACT INFORMATION	University of Colorado Boulder 429 UCB, 3775 Discovery Drive Boulder, CO 80303, USA	kenshiro.oguri@colorado.edu http://labusers.net/~kenoguri/
CITIZENSHIP	Japan	
EDUCATION	Ph.D. in Aerospace Engineering Sciences University of Colorado Boulder, USA Dissertation: <i>Risk-aware Mission Design around Small Celestial Bodies</i> Advisor: Jay W. McMahon	Spring 2021 (expected)
	M.S. in Aeronautics and Astronautics The University of Tokyo, Japan Advisor: Shin-ichi Nakasuka and Ryu Funase	Mar 2017
	B.S. in Aeronautics and Astronautics The University of Tokyo, Japan	Mar 2015
ACADEMIC APPOINTMENTS	NASA JPL Visiting Student Researcher Outer planet mission analysis group, Mission design and navigation section Mentor: Gregory Lantoine and Jon Sims Project: <i>SRP-based orbit control for solar sailing with application to NEA Scout</i>	Sept – Nov 2019
	NASA JPL Visiting Student Researcher Outer planet mission analysis group, Mission design and navigation section Mentor: Gregory Lantoine and Jon Sims Project: <i>Investigating non-Keplerian dynamics around Psyche</i>	June – Aug 2018
	JAXA ISAS Assistant Researcher Institute of Space and Astronautical Science, JAXA Mentor: Stefano Campagnola, Yasuhiro Kawakatsu, and Ryu Funase Project: <i>Mission design of SmallSat deep-space exploration</i>	Apr 2015 – Aug 2017
FELLOWSHIPS	Masason Foundation Fellowship [Link] Five-year full funding for Ph.D. study abroad. Success rate ~8.7%. Agency: Masason foundation, Japan	Aug 2017 – Present
	Nakajima Foundation Study Abroad Fellowship [Link] Two-year full funding for Ph.D. study abroad. Success rate ~14%. Agency: Nakajima foundation, Japan	Aug 2017 – July 2019
	Japanese Government JSPS DC1 Research Fellowship [Link] Most prestigious fellowship for Ph.D. study in Japan with three-year stipend funding. Terminated when leaving Japan to start Ph.D. study in the U.S. Success rate ~21%. Agency: Japan Society for the Promotion of Science (JSPS)	Apr – Aug 2017
	Japanese Government MEXT Leading Graduate Schools Fellowship [Link] Two-year stipend funding for graduate study. Success rate unknown. Agency: Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan	Apr 2015 – Mar 2017

RESEARCH INTERESTS	<p>Academic Fields of Interest: Astrodynamics; Control; Estimation; Optimization; Dynamical systems; Stochastic systems</p> <p>Current Research: Spacecraft Guidance, Navigation, and Control (GNC); Space trajectory optimization; Safety-critical space mission design; Small-body exploration; SmallSat mission design; Stochastic optimal control</p>
RESEARCH CONTRIBUTION AREAS	<p>Stochastic Optimal Control for Astrodynamics Applications</p> <ul style="list-style-type: none"> – Integrate stochastic optimal control into astrodynamics – Related publications: (J3), (C1), (C2), (C3), (C4), (C5) <p>Convex Optimization-based Space Mission Design</p> <ul style="list-style-type: none"> – Leverage the efficiency and reliability of convex optimization to design space missions – Related publications: (J3), (J4), (C2), (C3), (C4) <p>Non-Keplerian Dynamics around Small Celestial Bodies</p> <ul style="list-style-type: none"> – Analyze perturbed dynamics around small bodies with application to science orbit design – Related publications: (J5), (C7), (J3), (C2) <p>Solar Radiation Pressure-based Orbit Control</p> <ul style="list-style-type: none"> – Develop solar sailing optimal orbit controller with application to GNC around small bodies – Develop indirect trajectory optimization techniques with application to interplanetary transfers – Related publications: (J2), (J6), (C6), (C8), (C10) <p>Solar Sail Attitude-Orbit Coupled Dynamics Modeling & Control</p> <ul style="list-style-type: none"> – Develop semi-analytical precise models and controllers for attitude-orbit coupled dynamics under sail membrane deformations – Related publications: (C12), (C15), (C16), (C13)
TEACHING EXPERIENCE	<p>UTokyo Graduate Teaching Assistant Spring 2016 <i>Exercise in Space Engineering</i>, Department of Aero&Astro, The University of Tokyo Junior-level course on Space Systems Engineering</p>
NASA PROJECTS	<p>NEA Scout mission [Link] Sept – Nov 2019</p> <ul style="list-style-type: none"> – NASA CubeSat solar sailing mission to explore Near-Earth Asteroids (NEAs) – Role: Visiting student researcher – Research project: <i>SRP-based Orbit Control for Solar Sailing missions</i> – Develop solar sailing trajectory indirect optimization with application to missed-thrust analysis – Related publications: (J2) <p>Psyche mission [Link] June – Aug 2018</p> <ul style="list-style-type: none"> – NASA discovery mission program (<i>Psyche: Journey to a Metal World</i>) – Role: Visiting student researcher – Research project: <i>Investigating non-Keplerian dynamics around Psyche</i> – Analyze highly-perturbed dynamics with application to science orbit design around (16) Psyche – Related publications: (J5), (C7) <p>Dismantling Rubble Pile Asteroids with AoES [Link] Aug 2017 – Present</p> <ul style="list-style-type: none"> – NASA Innovative Advanced Concepts (NIAC) program (Phase I & II) – Role: Graduate research assistant – Design mission architectures of soft-robot-based asteroid exploration concepts – Develop guidance & control algorithms for SRP-based landing on asteroids – Related publications: (J6), (C10), (C9)
JAXA PROJECTS	<p>EQUULEUS: Equilibrium Lunar-Earth point 6U Spacecraft [Link] Jan 2016 – Aug 2017</p> <ul style="list-style-type: none"> – JAXA CubeSat mission to explore cislunar space with low energy transfer – Role: Systems engineer lead & Mission designer

- Perform high-level design of mission concept & spacecraft systems; Design low-energy transfers & science orbits (EML2 NRHOs) and analyze the station-keeping cost of science orbits
 - Related publications: (J7), (J9), (C11)
- PROCYON: Proximate Object Close Flyby with Optical Navigation** [\[Link\]](#) Apr 2014 – Aug 2017
- JAXA SmallSat mission that successfully explored deep space for the first time as a SmallSat
 - Role: Spacecraft GNC engineer
 - Develop GNC flight software in C language and analyze GNC flight data
 - Related publications: (J8), (J10), (C21)
- INDIVIDUAL AWARDS**
- AAS GNC Conference Student Paper Competition Second Prize** [\[Link\]](#) Feb 2020
Awarded for paper *Autonomous Guidance for Robust Achievement of Science Observations around Small Bodies*, from American Astronautical Society Rocky Mountain Section
- CCAR Bahls Endowed Funds – Travel Award** [\[Link\]](#) Jan 2019
Awarded for paper *Science Orbit Design with Frozen Beta angle: Theory and Application to Psyche mission*, from Colorado Center for Astrodynamics Research
- AAS John V. Breakwell Student Award** [\[Link\]](#) Aug 2018
Awarded for paper *SRP-based Orbit Control with Application to Small Body Landing*, from Space Flight Mechanics committee, American Astronautical Society
- UTokyo Tuition Fee Half Exemption for Outstanding Students** Apr 2017
Awarded from the University of Tokyo for academic excellence
- JSASS Outstanding Student Presentation Award** Oct 2016
Awarded for paper *Time-optimal Attitude Control with Application to Orbit Control of Spinning Solar Sail Driven by Reflectivity Control*, from Japan Society for Aeronautical and Space Sciences
- Travel Awards for Overseas Conference Presentation** Feb, June, July 2016
Awarded from Ministry of Education, Culture, Sports, Science and Technology, Japan; Tokyo electric power company holdings memorial foundation, Japan; Murata science foundation, Japan
- GROUP AWARDS**
- Japanese Government MEXT Commendation for Science and Technology** Mar 2017
Awarded for the world-first deep-space flight as a SmallSat (PROCYON mission), from Ministry of Education, Culture, Sports, Science and Technology, Japan
- UTokyo University President’s Award** Mar 2015
Awarded for the PROCYON mission from the University of Tokyo
- RESEARCH GRANTS**
- Research Grant for Masason Fellows** FY2017 – FY2020
Project: *On Robotic Asteroid Exploration: Spacecraft Autonomy and Cost-effective Exploration*
Agency: Masason foundation, Japan. FY 2017 – 2020 Total: 1,880,000 JPY (~18,800 USD)
- Japanese Government JSPS Grants-in-Aid for Scientific Research** FY2017
Project: *Robust Optimal Guidance and Control for Solar Sails with Modeling Uncertainty*
Agency: Japan Society for the Promotion of Science. FY 2017: 1,000,000 JPY (~10,000 USD)
- JOURNAL PUBLICATIONS**
- Articles in Preparation**
- (J1) **K. Oguri** and J. W. McMahon. Stochastic Primer Vector for Robust Low-thrust Trajectory Design under Uncertainty. *Journal of Guidance, Control, and Dynamics*, in preparation,
 - (J2) **K. Oguri**, G. Lantoine, and J. W. McMahon. Solar Sailing Primer Vector with Modified Equinoctial Elements. *Journal of Guidance, Control, and Dynamics*, in preparation
- Articles under Review**

- (J3) **K. Oguri** and J. W. McMahon. Robust Spacecraft Guidance around Small Bodies under Uncertainty: Stochastic Optimal Control Approach. *Journal of Guidance, Control, and Dynamics*, under review,
- (J4) N. Ozaki, **K. Oguri**, and R. Funase. PROCYON Mission Reanalysis: Low-Thrust Asteroid Flyby Trajectory Design leveraging Convex Programming. *Journal of the Astronautical Sciences*, under review

Published Articles

- (J5) **K. Oguri**, G. Lantoine, W. Hart, and J. McMahon. Science orbit design with a quasi-frozen beta angle: effects of body obliquity on J2-perturbed dynamics. *Celestial Mechanics and Dynamical Astronomy*, 132(10):48, Oct. 2020. doi: 10.1007/s10569-020-09987-z [\[Link\]](#)
- (J6) **K. Oguri** and J. W. McMahon. Solar Radiation Pressure–Based Orbit Control with Application to Small-Body Landing. *Journal of Guidance, Control, and Dynamics*, 43(2):195–211, Feb. 2020. doi: 10.2514/1.G004489 [\[Link\]](#)
- (J7) **K. Oguri**, K. Oshima, S. Campagnola, K. Kakihara, N. Ozaki, N. Baresi, Y. Kawakatsu, and R. Funase. EQUULEUS Trajectory Design. *The Journal of the Astronautical Sciences*, 67(3): 950–976, Sept. 2020. doi: 10.1007/s40295-019-00206-y [\[Link\]](#)
- (J8) S. Ikari, T. Ito, **K. Oguri**, T. Inamori, S. Sakai, Y. Kawakatsu, A. Tomiki, and R. Funase. In Orbit Demonstration of a FDIR Algorithm for the Attitude Control System of Micro Interplanetary Spacecraft PROCYON. *Journal of the Japan Society for Aeronautical and Space Sciences*, 68 (2):89–95, 2020. doi: 10.2322/jjsass.68.89 (Japanese) [\[Link\]](#)
- (J9) S. Campagnola, J. Hernando-ayuso, K. Kakihara, Y. Kawabata, T. Chikazawa, R. Funase, N. Ozaki, N. Baresi, T. Hashimoto, Y. Kawakatsu, T. Ikenaga, **K. Oguri**, and K. Oshima. Mission Analysis for the EM-1 CubeSats EQUULEUS and OMOTENASHI. *IEEE Aerospace and Electronic Systems Magazine*, 34(4):38–44, Apr. 2019. doi: 10.1109/MAES.2019.2916291 [\[Link\]](#)
- (J10) S. Ikari, T. Inamori, T. Ito, K. Ariu, **K. Oguri**, M. Fujimoto, S. Sakai, Y. Kawakatsu, and R. Funase. Attitude Determination and Control System for the PROCYON Micro-Spacecraft. *Transactions of the Japan Society for Aeronautical and Space Sciences*, 60(3):181–191, 2017. doi: 10.2322/tjsass.60.181 [\[Link\]](#)

CONFERENCE PROCEEDINGS (SELECTED)

- (C1) **K. Oguri** and J. W. McMahon. Stochastic Primer Vector for Robust Impulsive Trajectory Design Under Uncertainty. In *AAS/AIAA Astrodynamics Specialist Conference*, South Lake Tahoe, CA (Virtual), Aug. 2020
- (C2) **K. Oguri** and J. W. McMahon. Autonomous Guidance for Robust Achievement of Science Observations around Small Bodies. In *AAS Guidance, Navigation, and Control conference*, Breckenridge, Colorado, Feb. 2020, **AAS GNC Conference Student Paper Competition Second Prize**
- (C3) **K. Oguri**, M. Ono, and J. W. McMahon. Convex Optimization over Sequential Linear Feedback Policies with Continuous-time Chance Constraints. In *2019 IEEE 58th Conference on Decision and Control (CDC)*, pages 6325–6331, Nice, France, Dec. 2019. IEEE. doi: 10.1109/CDC40024.2019.9029604
- (C4) **K. Oguri** and J. W. McMahon. Risk-aware Trajectory Design with Impulsive Maneuvers: Convex Optimization Approach. In *AAS/AIAA Astrodynamics Specialist Conference*, Portland, ME, 2019
- (C5) **K. Oguri** and J. W. McMahon. Risk-aware Trajectory Design with Continuous Thrust: Primer Vector Theory Approach. In *AAS/AIAA Astrodynamics Specialist Conference*, Portland, ME, 2019
- (C6) **K. Oguri** and J. W. McMahon. SRP-based Orbit Control for Asteroid Exploration. In *32nd International Symposium on Space Technology and Science*, Fukui, Japan, 2019
- (C7) **K. Oguri**, G. Lantoine, B. Hart, and J. W. McMahon. Science Orbit Design with Frozen Beta angle: Theory and Application to Psyche mission. In *AAS/AIAA Space Flight Mechanics Meeting*, Ka’anapali, HI, 2019, **Bahls Endowed Funds Travel Award**
- (C8) **K. Oguri** and J. W. McMahon. SRP-based Orbit Control with Application to Orbit Stationkeeping at Small Bodies. In *AAS/AIAA Space Flight Mechanics Meetings Space Flight*,

- Ka'anapali, HI, 2019,
- (C9) J. McMahon, S. K. Mitchell, **K. Oguri**, N. Kellaris, D. Kuettel, C. Keplinger, and B. Bercovici. Area-of-Effect Softbots (AoES) for Asteroid Proximity Operations. In *2019 IEEE Aerospace Conference*, pages 1–16, Big Sky, Montana, Mar. 2019. IEEE. doi: 10.1109/AERO.2019.8741680
- (C10) **K. Oguri** and J. W. McMahon. SRP-based Orbit Control with Application to Small Body Landing. In *AAS/AIAA Astrodynamics Specialist Conference*, Snowbird, UT, 2018, **John V. Breakwell student award**
- (C11) **K. Oguri**, K. Kakihara, S. Campagnola, N. Ozaki, K. Oshima, T. Yamaguchi, and R. Funase. EQUULEUS Mission Analysis: Design of the Science Orbit Phase. In *International Symposium on Space Flight Dynamics*, Ehime, Japan, June 2017
- (C12) **K. Oguri**, A. Ishikawa, S. Ikari, T. Kudo, and R. Funase. Precision Evaluation of Reduced Dynamics Model for Non-uniform Spinning Solar Sail Driven by Reflectivity Control. In *4th International Symposium on Solar Sailing, 17045*, Kyoto, Japan, 2017
- (C13) A. Ishikawa, **K. Oguri**, S. Ikari, R. Funase, and S. Nakasuka. Estimation of Shape and Optical Parameters of Spinning Solar Sail Equipped with Reflectivity Control Devices. In *26th International Symposium on Space Flight Dynamics*, pages 1–6, 2017
- (C14) **K. Oguri**, T. Kudo, and R. Funase. Design Criteria of Reflectivity Control System Under Uncertainty in Sail Property for Maneuverability Requirement of Spinning Solar Sail. In *AIAA/AAS Astrodynamics Specialist Conference*, Long Beach, California, Sept. 2016. American Institute of Aeronautics and Astronautics. doi: 10.2514/6.2016-5674
- (C15) **K. Oguri** and R. Funase. Time-optimal Attitude Control Law with a Strategy of Applying to Orbital Control for Spinning Solar Sail Driven by Reflectivity Control. *Advances in the Astronautical Sciences*, 158:933–951, 2016
- (C16) **K. Oguri**, T. Kudo, and R. Funase. Time-Optimal Attitude Control and its Application to Orbital Control of Spinning Solar Sail Driven by Reflectivity Control. In *60th Space Sciences and Technology Conference, 2016-P34*, Hokkaido, Japan, 2016, **Outstanding student presentation award**
- (C17) S. Nomura, R. Takahashi, M. Ikura, **K. Oguri**, T. Obata, S. Ikari, and R. Funase. Initial Design of EQUULEUS Attitude Determination and Control System : How to Design an ADCS with High Reliability for a Deep Space CubeSat. In *31st International Symposium on Space Technology and Science*, pages 1–6, 2017
- (C18) T. Kudo, **K. Oguri**, and R. Funase. Rapid Control of Attitude Angles for Spinning Solar Sail Utilizing Spin Rate Change with Reflectivity Control Devices. In *4th International Symposium on Solar Sailing, 17048*, pages 1–6, Kyoto, Japan, 2017
- (C19) S. Campagnola, N. Ozaki, **K. Oguri**, Q. Verspieren, K. Kakihara, K. Yanagida, R. Funase, H. C. Yam, L. Ferella, T. Yamaguchi, Y. Kawakatsu, and G. D. Yarnoz. Mission Analysis for EQUULEUS, JAXA's Earth-Moon Libration Orbit Cubesat. In *67th International Astronautical Congress*, Guadalajara, 2016
- (C20) R. Funase, S. Ikari, N. Ozaki, S. Nakajima, K. Ariu, **K. Oguri**, T. Kudo, Y. Koshiro, K. Tokunaga, M. Tomooka, S. Nomura, A. Wachi, T. Arai, T. Iwata, M. Otsuki, and A. Tomiki. Close Flyby Observation of An Asteroid by A Small Probe PROCYON mini and Rendezvous Docking Experiment in Deep Space. In *60th Space Sciences and Technology Conference, 2016-2D08*, Hokkaido, Japan, 2016
- (C21) T. Ito, S. Ikari, **K. Oguri**, M. Fujimoto, K. Ariu, Y. Kawabata, T. Inamori, S. Sakai, Y. Kawakatsu, and R. Funase. Preliminary Study of Angular Momentum Control by Solar Radiation Pressure for 50 kg-class Spacecraft PROCYON. In *59th Space Sciences and Technology Conference, 2015-3J08*, pages 1–6, Kagoshima, Japan, 2015, **Young researcher award**

INVITED TALKS “Robust in-situ Asteroid Exploration,” at *JAXA ISAS Planetary Exploration Workshop*, Sagamihara, Japan (Virtual), 2020.

PRESENTATIONS (P1) “Stochastic Primer Vector for Robust Impulsive Trajectory Design Under Uncertainty,” at

- AAS/AIAA *Astrodynamics Specialist Conference*, South Lake Tahoe, CA (Virtual), 2020.
- (P2) “Autonomous Guidance for Robust Achievement of Science Observations around Small Bodies,” at *AAS Guidance, Navigation, and Control conference*, Breckenridge, Colorado, 2020, **AAS GNC Conference Student Paper Competition Second Prize**
- (P3) “Convex Optimization over Sequential Linear Feedback Policies with Continuous-time Chance Constraints,” at *2019 IEEE Conference on Decision and Control*, Nice, France, 2019.
- (P4) “Risk-aware Trajectory Design with Continuous Thrust: Primer Vector Theory Approach,” at *AAS/AIAA Astrodynamics Specialist Conference, AAS 19-912*, Portland, ME, 2019.
- (P5) “Risk-aware Trajectory Design with Impulsive Maneuvers: Convex Optimization Approach,” at *AAS/AIAA Astrodynamics Specialist Conference, AAS 19-893*, Portland, ME, 2019.
- (P6) “SRP-based Orbit Control for Asteroid Exploration”, at *32nd International Symposium on Space Technology and Science, ISTS 2019-d-021*, Fukui, Japan, 2019.
- (P7) “Science Orbit Design with Frozen Beta angle: Theory and Application to Psyche mission”, at *2019 AAS/AIAA Space Flight Mechanics Meeting, AAS 19-269*, Ka’anapali, HI, 2019, **Bahls Endowed Funds Travel Award**
- (P8) “SRP-based Orbit Control with Application to Orbit Stationkeeping at Small Bodies”, at *2019 AAS/AIAA Space Flight Mechanics Meeting, AAS 19-415*, Ka’anapali, HI, 2019.
- (P9) “SRP-based Orbit Control with Application to Small body Landing”, at *2018 AAS/AIAA Astrodynamics Specialist Conference, AAS 18-375*, Snowbird, UT, 2018, **John V. Breakwell student award**.
- (P10) “EQUULEUS Mission Analysis: Design of the Science Orbit Phase”, at *26th International Symposium on Space Flight Dynamics, ISSFD-2017-072*, Ehime, Japan, 2017.
- (P11) “Precision Evaluation of Reduced Dynamics Model for Non-uniform Spinning Solar Sail Driven by Reflectivity Control”, at *4th International Symposium on Solar Sailing, ISSS-17045*, Kyoto, Japan, 2017.
- (P12) “Mission Concept and System Design of World-First Cis-Lunar Space Exploration CubeSat EQUULEUS”, at *17th ISAS/JAXA Space Science Symposium, 2016-P-24*, Kanagawa, Japan, 2017.
- (P13) “Attitude Maneuverability Estimation for Preliminary Mission Design of Spinning Solar Sail Driven by Reflectivity Control” at *the AIAA/AAS Astrodynamics Specialist Conference, AIAA2016-5674*, Long Beach, California, 2016.
- (P14) “Optimal Attitude and Orbital Control Strategy of Spinning Solar Sail Spacecraft via Reflectivity Control” at *26th AAS/AIAA Space Flight Mechanics Meeting, AAS 16-329*, Napa, California, 2016.
- (P15) “Time-Optimal Attitude Control and its Application to Orbital Control of Spinning Solar Sail Driven by Reflectivity Control” at *60th Space Sciences and Technology Conference, 2016-P34*, Hokkaido, Japan, 2016. **Outstanding student presentation award**
- (P16) “On-Orbit Estimation of ADCS Parameters for micro-astrometry satellite ‘Nano-JASMINE’” at *59th Space Sciences and Technology Conference, 2015-3J13*, Kagoshima, Japan, 2015.
- (P17) “Time-Optimal Attitude Control of Spinning Solar Sail by Reflectivity Control” at *25th Workshop on JAXA Astrodynamics and Flight Mechanics, 2015-C-11*, Kanagawa, Japan, 2015.
- (P18) “Optimal Attitude Control of Spinning Solar Sail with Reflectivity Control” at *30th International Symposium on Space Technology and Science, 2015-d-26*, Kobe, Japan, 2015.

SERVICE

Professional Memberships

- American Astronautical Society (AAS)
- American Institute of Aeronautics and Astronautics (AIAA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Society for Industrial and Applied Mathematics (SIAM)

Technical Journal Referee Activities

- AIAA Journal of Guidance, Control, and Dynamics (JGCD)
- Advances in Space Research (COSPAR, Elsevier)

University Community Service

- International Student Advisory Board (founding member), College of Engineering and Applied Science, University of Colorado Boulder

Last updated: November 5, 2020