Ryota Nakano – Curriculum Vitae

Space Technology Applications Research (STAR) Lab,
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Education

Ph.D. student in Aerospace Engineering, Auburn University Aug. 2019 - 2024 (Expected)
GPA: 4.00/4.00

B.S., Aerospace Engineering, The University of Alabama in Huntsville May 2019
GPA: 3.99/4.00, Summa Cum Laude

Professional Experience

Graduate Research Assistant, STAR Lab, Auburn University Aug. 2019 - Present
Advisor: Prof. Masatoshi Hirabayashi

Graduate Teaching Assistant, Auburn University Aug. 2019 - May 2020

Undergraduate Research Assistant,
- **KangLab, UAH** May 2018 - May 2019
  Advisor: Prof. Chang-kwon Kang
- **Plasma and Electrodynamics Research Lab, UAH** Oct. 2016 - Jul. 2018
  Advisor: Prof. Gabe Xu

Research Topics/Projects

Thermophysical modeling of celestial bodies May 2020 - Present
- Developing a Finite Element Method approach thermophysical model to investigate, for example, the Yarkovsky and YORP effects
- Related publications: (J1), (C2)-(C5), (C7), (PP2)

Dynamics modeling of binary asteroid systems Aug. 2019 - Present
- Investigating how shape modification affects mutual body dynamics
- Participating in NASA DART Dynamics Working Group
- Related publications: (J2), (C6), (C8), (PP3)

Structural analysis of small solar system bodies Aug. 2019 - Present
- Developed a semi-analytical model to predict the rotationally induced structural failure condition of small bodies
- Related publications: (J4), (J5), (C9)-(C12), (PP4)

Marsbee Project - NIAC 2018 Phase-I May 2018 - May 2019
- Role: Undergraduate Research Assistant
- Developed 6-DoF computational model that couples the flight dynamics and aerodynamics of insect-scale flapping wing vehicles

Development of a metronome thrust stand Aug. 2017 - Jul. 2018
- Proposed the metronome configuration as a unique design solution and archived significant reduction in size compared to traditional thrust stands
- Related publications: (C13)

Development of cylindrical Hall effect thruster Oct. 2016 - Jul. 2018
- Developed a thruster for small satellites using 3D-printed materials
- Related publications: (C13), (PP5)

Awards/Fellowships

Future Investigators in NASA Earth and Space Science and Technology 2021 - 2024

- Proposal title: *BYORP's Nightmare Induced by Geophysical and Dynamical Properties of Binary Asteroids Revealed by FEM Approach*
- Total of $135,000 research funding (including supports for stipend, tuition, travel, etc.)

1st Place in NESF Student Poster Competition Jul. 2020

- Awarded for poster presentation *Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation* at NASA Exploration Science Forum, (PP4).

Presidential Graduate Research Fellowship 2019 – 2022

- Awarded from Auburn University.
- Three-year full funding for graduate study.

Undergraduate Super Scholar Transfer Scholarship 2016 – 2018

- Awarded from The University of Alabama in Huntsville.
- Two-year stipend funding for undergraduate study.

Journal Publication

(J1) (In preparation) **R. Nakano** and M. Hirabayashi, "Finite Element Modeling Approach 3-Dimensional Thermophysical Model for Celestial Bodies," The Planetary Science Journal

(J2) (In preparation) **R. Nakano** and M. Hirabayashi, "Reshaping-induced Perturbation on Didymos' Mutual Orbit," The Planetary Science Journal

(J3) (Under review) P. M. Jackson, **R. Nakano**, Y. Kim, and M. Hirabayashi, "Active Main-Belt Asteroid (6478) Gault - Constraint on Its Cohesive Strength and the Fate of Ejected Particles in the Solar System," The Planetary Science Journal

(J4) M. Hirabayashi, **R. Nakano**, and 15 colleagues, "Spin-driven evolution of asteroids' top-shapes at fast and slow spins as seen from (101955) Bennu and (162173) Ryugu," Icarus, 352, 2020, doi: 10.1016/j.icarus.2020.113946

(J5) **R. Nakano** and M. Hirabayashi, "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation," The Astrophysical Journal Letters, 899(2), L22, 2020, doi: 10.3847/2041-8213/ab7d36

Conference Proceedings

(C1) **R. Nakano**, Ehsan Taheri, and M. Hirabayashi, "Time-Optimal and Fuel-Optimal Trajectories for Asteroid Landing via Indirect Optimization," *AIAA SciTech Forum and Exposition*, 2022 (Submitted)

(C2) **R. Nakano** and M. Hirabayashi, "Finite Element Thermophysical Model for The Yarkovsky and YORP Effect Investigations – YORP Effect's Insensitivity to Small Topographic Features," *American Geophysical Union Fall Meeting* (Submitted)

(C3) **R. Nakano** and M. Hirabayashi, "Finite element thermophysical model for the Yarkovsky and YORP calculations, insensitive to small topographic effects," *AAS Division for Planetary Sciences Meeting*, virtual meeting, 2021

(C4) **R. Nakano** and M. Hirabayashi, "Investigation of the YORP effect on asteroid (162173) Ryugu – An application of FEM approach thermophysical model," *Europlanet Science Congress*, virtual meeting, 2021, EPSC2021-441

(C5) **R. Nakano** and M. Hirabayashi, "Finite Element Modeling Approach Thermophysical Model to Characterize Irregularly Shaped Bodies' Temperature Variation," *NASA Exploration Science Forum & European Lunar Symposium*, virtual meeting, 2021

(C6) **R. Nakano** and M. Hirabayashi, "NASA/Double Asteroid Redirection Test: Orbital perturbation by the ejecta-collision driven reshaping of Didymos after the impact event," *7th IAA Planetary Defense Conference*, virtual meeting, 2021

(C7) **R. Nakano** and M. Hirabayashi, "Finite Element Modeling Approach to Characterize Temperature Variations of Irregularly Shaped Bodies," *52nd Lunar and Planetary Science Conference*, virtual meeting, 2021

(C8) **R. Nakano**, M. Hirabayashi, and 10 colleagues, "Dimorphos' orbital perturbation induced by shape modification of Didymos after the DART impact," *American Geophysical Union Fall Meeting*, virtual meeting, 2020, NH037-0004

(C9) M. Hirabayashi, **R. Nakano**, and 15 colleagues, "Spin-driven evolution of asteroids' top-shapes at fast and slow spins as seen from (101955) Bennu and (162173) Ryugu,' *AAS Division for Planetary Science Meeting*, virtual meeting, 2020

(C10) **R. Nakano** and M. Hirabayashi, "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation - Implication to Asteroid Pairs," *Europlanet Science Congress*, virtual meeting, 2020, EPSC2020-540, doi: 10.5194/epsc2020-540

(C11) **R. Nakano** and M. Hirabayashi, "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation," *NASA Exploration Science Forum*, virtual meeting, 2020

(C12) **R. Nakano** and M. Hirabayashi, "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation," *51st Lunar and Planetary Science Conference*, The Woodlands, TX, 2020, LPSC2020-1742 (Canceled due to COVID19 pandemic)

(C13) **R. Nakano** and K.G. Xu, "Development of a Metronome Thrust Stand for Miniature Electric Propulsion," *AIAA Propulsion and Energy Forum*, Cincinnati, OH, 2018

Presentations

Oral

(PO1) "Finite element thermophysical model for the Yarkovsky and YORP calculations, insensitive to small topographic effects," *AAS Division for Planetary Sciences Meeting*, virtual meeting, 2021

(PO2) "Investigation of the YORP effect on asteroid (162173) Ryugu – An application of FEM approach thermophysical model," *Europlanet Science Congress*, virtual meeting, 2021

(PO3) "NASA/Double Asteroid Redirection Test: Orbital perturbation by the ejecta-collision driven reshaping of Didymos after the impact event," at *7th IAA Planetary Defense Conference*, virtual meeting, 2021

(PO4) "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation - Implication to Asteroid Pairs," at *Europlanet Science Congress*, virtual meeting, 2020

(PO5) "Development of a Metronome Thrust Stand for Miniature Electric Propulsion," at *AIAA Propulsion and Energy Forum*, Cincinnati, OH, 2018

Poster

(PP1) "Finite Element Modeling Approach Thermophysical Model to Characterize Irregularly Shaped Bodies' Temperature Variation," at *NASA Exploration Science Forum & European Lunar Symposium*, virtual meeting, 2021

(PP2) "Finite Element Modeling Approach to Characterize Temperature Variations of Irregularly Shaped Bodies," at *52nd Lunar and Planetary Science Conference*, virtual meeting, 2021

(PP3) "Dimorphos' orbital perturbation inducedby shape modification of Didymos after the DART impact," at *American Geophysical Union Fall Meeting*, virtual meeting, 2020

(PP4) "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation," at *NASA Exploration Science Forum*, virtual meeting, 2020

(PP5) "Cylindrical Hall effect thruser with 3D printed components for small satellite propulsion," at *AAS 10th Wernher von Braun Memorial Symposium*, Huntsville, AL, 2017