Ryota Nakano – Curriculum Vitae

Space Technology Applications Research (STAR) Lab,
Department of Aerospace Engineering,
Auburn University,
Auburn, AL 36832, USA

Citizenship: Japan
Email: rzn0040@auburn.edu
Phone: (334)-524-0058
https://rnakano1230.github.io

Education

Ph.D. student in Aerospace Engineering, Auburn University Aug. 2019 - Dec. 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, UAHuntsville

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

Research Topics/Projects

Numerical investigation of Binary-YORP effect Jan. 2022 - Present

- Investigating the BYORP effect in unprecedented detail by combining the dynamical and thermophysical models
- Publications: (C1)

Thermophysical modeling of celestial bodies May 2020 - Present

- Developing a Finite Element Method approach 3D thermophysical model to investigate the Yarkovsky and YORP effects
- Publications: (J2), (C4)-(C7), (C9), (PP2), (PP3)

Dynamics modeling of binary asteroid systems Aug. 2019 - Present

- Investigating how shape modification affects mutual body dynamics
- NASA/DART Dynamics Working Group member
- Publications: (J1),(J3)-(J5), (C2), (C8), (PP1), (PP4)

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
- Publications: (J6)-(J8), (C11)-(C14), (PP5)

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
- Publications: (C15)

Development of cylindrical Hall effect thruster Oct. 2016 - Jul. 2018

- Developed a thruster for small satellites using 3D-printed materials
- Publications: (C15), (PP6)

Awards/Fellowships

Small Body Assessment Group (SBAG) Meeting Participation Stipend Jun. 2022

- Awarded $2,000 from SBAG to attend 27th SBAG meeting in Washington D.C.

Division of Dynamical Astronomy (DDA) Supplemental Travel Grant Apr. 2022

- Awarded $750 from DDA to attend 53rd DDA meeting in Manhattan, NY.

NASA FINESST 2022 - 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: *Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation* at NASA Exploration Science Forum, (PP5)

Presidential Graduate Research Fellowship 2019 – 2022

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

Undergraduate Super Scholar Transfer Scholarship 2016 – 2018

- Two-year stipend funding for undergraduate study from UAHuntsville

Journal Publication

(J1) (Submitted) T. S. Statler, and 40 authors (**R. Nakano**, the 27th author), "After DART: Using the first full-scale test of a kinetic impactor to inform a future planetary defense mission," The Planetary Science Journal

(J2) (Submitted) **R. Nakano** and M. Hirabayashi, "Finite Element Method Approach 3-Dimensional Thermophysical Model for YORP torque computation," Icarus

(J3) D. C. Richardson, and 35 authors (**R. Nakano**, the 25th author), "Predictions for the Dynamical States of the Didymos System Before and After the Planned DART Impact," The Planetary Science Journal, 3, 157, 2022, doi:10.3847/PSJ/ac76c9

(J4) **R. Nakano**, and 8 authors, "NASA/Double Asteroid Redirection Test (DART): Mutual Orbital Period Change Due to Reshaping in the Near-Earth Binary Asteroid System (65803) Didymos," The Planetary Science Journal, 3, 7, 2022, doi: 10.3847/PSJ/ac7566

(J5) M. Hirabayashi, and 13 authors (**R. Nakano**, the 4th author), "Double Asteroid Redirection Test (DART): Structural and dynamic interactions between asteroidal elements of Binary Asteroid (65803) Didymos," The Planetary Science Journal, 3, 6, 2022, doi: 10.3847/PSJ/ac6eff

(J6) 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, 3, 16, 2022, doi: 10.3847/PSJ/ac4031

(J7) M. Hirabayashi, **R. Nakano**, and 15 authors, "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

(J8) **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** and M. Hirabayashi, "A new binary-YORP effect model combining full two rigid body dynamics and three-dimensional thermophysical evolution," *AAS Division of Dynamical Astronomy Meeting*, Manhattan, NY, 2022

(C2) **R. Nakano** and M. Hirabayashi, "Dimorphos' reshaping-induced orbital period change after the DART impact." *53rd Lunar and Planetary Science Conference*, The Woodlands, TX, 2022, LPSC2022-2025

(C3) **R. Nakano**, Ehsan Taheri, and M. Hirabayashi, "Time-Optimal and Fuel-Optimal Trajectories for Asteroid Landing via Indirect Optimization," *AIAA SciTech Forum and Exposition*, San Diego, CA, 2022, AIAA 2022-1128, doi: 10.2514/6.2022-1128

(C4) **R. Nakano** and M. Hirabayashi, "Finite Element Thermophysical Model for The Yarkovsky and YORP Effect Investigations – The YORP Effect's Insensitivity to Small Topographic Features," *American Geophysical Union Fall Meeting*, 2021

(C5) **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

(C6) **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, doi: 10.5194/epsc2021-441

(C7) **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

(C8) **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

(C9) **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, LPSC2021-1292

(C10) **R. Nakano**, M. Hirabayashi, and 10 authors, "Dimorphos' orbital perturbation induced by shape modification of Didymos after the DART impact," *American Geophysical Union Fall Meeting*, virtual meeting, 2020, NH037-0004

(C11) M. Hirabayashi, **R. Nakano**, and 15 authors, "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

(C12) **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

(C13) **R. Nakano** and M. Hirabayashi, "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation," *NASA Exploration Science Forum*, virtual meeting, 2020

(C14) **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)

(C15) **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) "A new binary-YORP effect model combining full two rigid body dynamics and three-dimensional thermophysical evolution" at *AAS Division on Dynamical Astronomy Meeting*, Manhattan, NY, 2022

(PO2) "Time-Optimal and Fuel-Optimal Trajectories for Asteroid Landing via Indirect Optimization," at *AIAA SciTech Forum and Exposition*, virtual meeting, 2022

(PO3) "Finite Element Thermophysical Model for The Yarkovsky and YORP Effect Investigations – The YORP Effect's Insensitivity to Small Topographic Features," at *American Geophysical Union Fall Meeting*, virtual meeting, 2021

(PO4) "Finite element thermophysical model for the Yarkovsky and YORP calculations, insensitive to small topographic effects," at *AAS Division for Planetary Sciences Meeting*, virtual meeting, 2021

(PO5) "Investigation of the YORP effect on asteroid (162173) Ryugu – An application of FEM approach thermophysical model," at *Europlanet Science Congress*, virtual meeting, 2021

(PO6) "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

(PO7) "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation - Implication to Asteroid Pairs," at *Europlanet Science Congress*, virtual meeting, 2020

(PO8) "Development of a Metronome Thrust Stand for Miniature Electric Propulsion," at *AIAA Propulsion and Energy Forum*, Cincinnati, OH, 2018

Poster

(PP1) "Dimorphos' reshaping-induced orbital period change after the DART impact," at *53rd Lunar and Planetary Science Conference*, The Woodlands, TX, 2022

(PP2) "Finite Element Modeling Approach Thermophysical Model to Characterize Irregularly Shaped Bodies' Temperature Variation," at *NASA Exploration Science Forum & European Lunar Symposium*, virtual meeting, 2021

(PP3) "Finite Element Modeling Approach to Characterize Temperature Variations of Irregularly Shaped Bodies," at *52nd Lunar and Planetary Science Conference*, virtual meeting, 2021

(PP4) "Dimorphos' orbital perturbation inducedby shape modification of Didymos after the DART impact," at *American Geophysical Union Fall Meeting*, virtual meeting, 2020

(PP5) "Mass-shedding Activities of Asteroid (3200) Phaethon Enhanced by Its Rotation," at *NASA Exploration Science Forum*, virtual meeting, 2020

(PP6) "Cylindrical Hall effect thruser with 3D printed components for small satellite propulsion," at *AAS 10th Wernher von Braun Memorial Symposium*, Huntsville, AL, 2017

Academic Services

Journal Review

- *The Planetary Science Journal*
- *Astronomy & Astrophysics*