Harrison F. Agrusa

Curriculum Vitae

Department of Astronomy
University of Maryland
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Education

2022 **PhD, Astronomy**, *University of Maryland*, College Park, (expected).

2019 **MS, Astronomy**, *University of Maryland*, College Park.

2017 **BA, Physics**, *University of California*, Berkeley.

2017 **BA, Astrophysics**, *University of California*, Berkeley.

Research & Work Experience

Dept. of Astronomy, University of Maryland

Aug., 2017 – present ***Orbital Dynamics of NASA DART Mission Target Binary Asteroid 65803 Didymos***.
As part of the Dynamics Working Group, I use numerical simulations to study the orbital dynamics of the binary asteroid Didymos, the target for NASA's Double Asteroid Redirect Test (DART) Mission. This work focuses on making pre- and post-impact predictions of the dynamical state of the Didymos system.

Advisor: **Prof. Derek C. Richardson**

High-Energy-Density Physics Internship, Lawrence Livermore National Laboratory

May, 2019 – Sept., 2019 ***Modeling Crater Formation and Momentum Transfer of a Kinetic Impactor for Planetary Defense***.
Using an Adaptive Smoothed Particle Hydrodynamics code, I simulated hyper-velocity impacts onto an asteroid surface in support of NASA's DART mission.

Advisors: **Dr. Dawn Graninger, Dr. Megan Bruck-Syal, Dr. Mike Owen**

May, 2016 – Sept., 2016 ***Energy Deposition and Shock Propagation in "Rubble-Pile" Asteroids***.
Using Monte Carlo radiation transport and multiphysics hydrodynamics simulation codes, I studied hazardous asteroid deflection using a nuclear explosive.

Advisors: **Dr. Rob Managan, Dr. Kirsten Howley**

Fellowships & Awards

2022 ***UMd Jacob K. Goldhaber Travel Award***

2022 ***Division of Dynamical Astronomy Supplemental Travel Award***

2020-2021 ***College of Computer, Mathematical, and Natural Sciences Dean's Fellow,*** $2500 stipend.

2019-2020 ***UMd Graduate School Outstanding Research Assistant Award,*** awarded for being named among the top 2% of campus Graduate Assistants in a given year.

2019-2020 ***John Chi-Lin Wang Award for Academic Excellence,*** awarded to the third-year graduate student with the best overall performance in course grades, second-year research project, and qualifying exam.

2019 ***Binary Asteroids 5 Workshop Student Travel Award***

2019 ***LLNL High-Energy Density Physics Summer Student Poster Award***

2017-2018 ***UMd Graduate School Dean's Fellowship,*** $10,000 graduate recruitment fellowship.

Refereed Publications

First- and second-author

2022 **Agrusa, H.F.,** Ferrari, F., Zhang, Y., et al., Dynamical Evolution of the Didymos-Dimorphos Binary Asteroid as Rubble Piles following the DART Impact, In *Planetary Science Journal* (in review).

2022 Richardson, D.C., **Agrusa, H.F.,** Barbee, B., Predictions for the Dynamical State of the Didymos System Before and After the Planned DART Impact, In *Planetary Science Journal* (in review).

2021 **Agrusa, H.F.,** Gkolias, I., Tsiganis, K., et al., The excited spin state of Dimorphos resulting from the DART impact, In *Icarus*.

2020 **Agrusa, H.F.,** Richardson, D.C., Davis, A.B., et al., A benchmarking and sensitivity study of the full two-body gravitational dynamics of the DART mission target, binary asteroid 65803 Didymos, In *Icarus*.

N-th Author

2022 Nakano, R., Hirabayashi, M., **Agrusa, H.F.,** et al., NASA Double Asteroid Redirection Test (DART): Mutual Orbital Period Change Due to Reshaping in the Near-Earth Binary Asteroid System (65803) Didymos, In *Planetary Science Journal* (in review).

2022 Kim, B.I., Boehm, R.D., **Agrusa, H.F.**, Coil-to-Bridge Transitions of Self-Assembled Water Chains Observed in a Nanoscopic Meniscus, In *Langmuir*.

2021 Marohnic, J.C., Richardson, D.C., McKinnon, W.B., **Agrusa, H.F.,** et al., Constraining the final merger of contact binary (486958) Arrokoth with soft-sphere discrete element simulations, In *Icarus*.

2021 Zhang, Y., Michel, P., Richardson, D.C., et al. (incl. **Agrusa, H.F.**), Creep stability of the DART/Hera mission target 65803 Didymos: II. The role of cohesion, In *Icarus*..

2021 Rivkin, A.S., Chabot, N.L., Stickle, A.M., et al. (incl. **Agrusa, H.F.**), The Double Asteroid Redirection Test (DART): Planetary Defense Investigations and Requirements, In *Planetary Science Journal*.

2021 Meyer, A.J., Gkolias, I., Gaitanas, M., **Agrusa, H.F.,** et al., Libration-induced Orbit Period Variations Following the DART Impact, In *Planetary Science Journal*.

Research Talks

2022 **Division of Dynamical Astronomy Annual Meeting**

2022 **University of Maryland Aerospace Engineering Seminar Series** (invited)

2019 **Binary Asteroids 5 Workshop**

2019 **University of Maryland Planetary Astronomy Late-morning Seminar (PALS)** (invited)

2019 **LLNL Summer Student Seminar**

2019 **LLNL Summer Studetn Seminar**

Press Coverage

2021 **BBC World Service Newsday**, *NASA: Mission to smash into Dimorphos space rock launches*.

2021 **CW39 Houston/KIAH**, *NASA's DART Mission kicks off with successful launch on its way to hit asteroid*.

2021 **Federal News Network WFED The Space Hour Podcast**, *Redirecting an asteroid as practice . . . just in case*.

2021 **iHeartRadio 610 WIOD**, *Live radio interview for launch of NASA's DART Mission*.

2021 **MIT Technology Review**, *NASA is going to slam a spacecraft into an asteroid. Things might get chaotic.*.

2021 **Stories from a Space Journalist Podcast**, *SpaceX makes history once again, and can we save Earth from an asteroid?*.

2019 **European Space Agency**, *Will DART make its target asteroid go wobbly? Hera will see*.

2019 **HPCwire**, *With the Help of HPC, Astronomers Prepare to Deflect a Real Asteroid*.

Teaching Experience

Teaching Assistant

Spring, 2021 **ASTR 320: Theoretical Astrophysics**, U. of Maryland.

Spring, 2020 **ASTR 101: Introduction to General Astronomy**, U. of Maryland.

Spring, 2019 **ASTR 101: Introduction to General Astronomy**, U. of Maryland.

Fall, 2018 **ASTR 415: Computational Astrophysics**, U. of Maryland.

Fall, 2018 **ASTR 100/101: Introduction to General Astronomy**, U. of Maryland.

Spring, 2018 **ASTR 220: Collisions in Space: The Threat of Asteroid Impacts**, U. of Maryland.

Fall, 2017 **ASTR 100/101: Introduction to General Astronomy**, U. of Maryland.

Spring, 2016 **Astro 12: The Planets**, UC Berkeley.

Fall, 2016 **Astro 10: General Astronomy**, UC Berkeley.

Tutoring

2017-present **MathSmart Tutoring**, *Private Tutor*.

2015-2017 **Dept. of Physics, UC Berkeley**, *Undergraduate Tutor*.

Research Advising

Alyssa Mazzone, *UMd*, YORP spin-up induced binary asteroid formation., Spring 2022 - present.

Peter Santana, *University of Puerto Rico at Mayagüez*, Formation of binary asteroids through gravitational reaccumulation, Winter 2020, *as part of UMd's GRADMAP outreach program*.

Meghna Sitaram, *UMd*, Tidal dissipation in rubble pile asteroids, Fall 2019 - Spring 2020.

Other Publications

Book Chapters

2022 Eiblum, D., Lee, E., **Agrusa, H.F.,** et al., GED Ultimate Study Guide: for the Math-Phobic, *Superlative Press*.

2021 Eiblum, D., Lee, E., **Agrusa, H.F.,** et al., Praxis Core Math 5733: A Workbook for the Math Phobic, *Superlative Press*.

2020 Eiblum, D., Lee, E., **Agrusa, H.F.,** et al., Praxis Core Math 2020: A Complete Course, *Superlative Press*.

Conference Proceedings

2022 **Agrusa, H. F.**, D. C. Richardson, B. Barbee, W. F. Bottke, A. F. Cheng, S. Eggl, F. Ferrari, M. Hirabayashi, O. Karatekin, J. McMahon, and S. R. Schwartz. Predictions for the Dynamical State of the Didymos System Before and After the Planned DART Impact. In *LPI Contributions*, volume 2678 of *LPI Contributions*, page 2447, March 2022.

2022 A. J. Meyer, D. J. Scheeres, I. G. Gkolias, M. Gaitanas, **Agrusa, H. F.**, K. Tsiganis, P. Pravec, L. A. M. Benner, F. Ferrari, and P. Michel. Libration-Induced Orbit Period Variations Following the DART Impact. In *LPI Contributions*, volume 2678 of *LPI Contributions*, page 2225, March 2022.

2021 Y. Zhang, P. Michel, D. C. Richardson, **Agrusa, H. F.**, K. Tsiganis, O. S. Barnouin, and O. Karatekin. Minimum Material Strength of Binary Asteroid Didymos-Dimorphos from the perspective of Structural Stability. In *IAA Planetary Defense Conference*, 2021.

2021 **Agrusa, H. F.**, I. Gkolias, K. Tsiganis, D. C. Richardson, A. Meyer, D. J. Scheeres, A. B. Davis, E. G. Fahnestock, M. Hirabayashi, and P. Michel. On the Post-impact Spin State of the Secondary Component of the Didymos-Dimorphos Binary Asteroid System. In *IAA Planetary Defense Conference*, 2021.

2020 Yun Zhang, Patrick Michel, Derek C. Richardson, Olivier S. Barnouin, **Agrusa, Harrison F.**, and Kleomenis Tsiganis. Structural stability and cohesive strength of 65803 Didymos. In *European Planetary Science Congress*, pages EPSC2020–660, September 2020.

2020 **Agrusa, Harrison**, Kleomenis Tsiganis, Ioannis Gkolias, Derek Richardson, Alex Davis, Eugene Fahnestock, and Masatoshi Hirabayashi. On the post-impact spin state of the secondary component of the Didymos-Dimorphos binary asteroid system. In *European Planetary Science Congress*, pages EPSC2020–377, September 2020.

2020 **Agrusa, H. F.**, K. Tsiganis, I. Gkolias, D. Richardson, A. Davis, E. Fahnestock, and M. Hirabayashi. On the post-impact spin state of the secondary component of the Didymos-Dimorphos binary asteroid system. In *AAS/Division for Planetary Sciences Meeting Abstracts*, volume 52 of *AAS/Division for Planetary Sciences Meeting Abstracts*, page 217.04, October 2020.

2020 A. M. Stickle, **Agrusa, H. F.**, M. DeCoster, D. Graninger, J. M. Owen, S. D. Raducan, T. Rosch, G. S. Collins, M. Bruck Syal, and DART Impact Modeling Working Group. Effects of Spaceraft Geometry on Potential Deflection by Kinetic Impactor. In *Lunar and Planetary Science Conference*, 2020.

2020 R. Nakano, M. Hirabayashi, **Agrusa, H. F.**, A. B. Davis, A. Meyer, Y. Yu, K. Tsiganis, B. Barbee, J. R. Lyzhoft, D. J. Scheeres, A. Rossi, and D. C. Richardson. Dimorphos' orbital perturbation induced by shape modification of Didymos after the DART impact. In *AGU Fall Meeting Abstracts*, volume 2020, pages NH037–0004, December 2020.

2020 Julian C. Marohnic, Derek C. Richardson, William B. McKinnon, **Agrusa, Harrison F.**, Joseph V. DeMartini, Andrew F. Cheng, S. Alan Stern, Cathy B. Olkin, Harold A. Weaver, and John R. Spencer. Constraining the final merger of contact binary (486958) Arrokoth with soft-sphere discrete element simulations. In *European Planetary Science Congress*, pages EPSC2020–378, September 2020.

2020 J. C. Marohnic, D. C. Richardson, W. B. McKinnon, **Agrusa, H. F.**, J. V. DeMartini, A. F. Cheng, S. Stern, C. B. Olkin, H. A. Weaver, J. R. Spencer, and New Horizons Science team. Constraining the final merger of contact binary (486958) Arrokoth with soft-sphere discrete element simulations. In *AAS/Division for Planetary Sciences Meeting Abstracts*, volume 52 of *AAS/Division for Planetary Sciences Meeting Abstracts*, page 508.03, October 2020.

2019 M. Hirabayashi, E. Fahnestock, **H. F. Agrusa**, D. C. Richardson, A.M. Stickle, C.M. Ernst, P. Sanchez, C. Thomas, O.S. Barnouin, N.L. Chabot, A. Rivkin, and A.F. Cheng. Finite element method approach for quantifying the conditions for shape deformation of the primary of binary asteroid Didymos after the DART impact. In *AGU Fall Meeting Abstracts*, 2019.

2019 **H. F. Agrusa**, A. B. Davis, D. C. Richardson, E. Fahnestock, and M. Hirabayashi. The Induced Libration of Didymos B Resulting from the DART Impact. In *AGU Fall Meeting Abstracts*, 2019.

2018 D. C. Richardson, E. Fahnestock, **H. F. Agrusa**, A. B. Davis, D. P. Hamilton, M. Hirabayashi, D. J. Scheeres, G. Tancredi, K. Tsiganis, Y. Yu, A. Campo Bagatin, A. F. Cheng, and P. Michel. Simulations of the Pre- and Post-impact System Dynamics of the DART Mission Target Binary Asteroid 65803 Didymos. In *AGU Fall Meeting Abstracts*, 2018.

2016 **H. F. Agrusa**, R. Managan, and K. Howley. Nuclear-Energy Deposition and Shock Propagation in Rubble-Pile Asteroids. In *ANS Winter Meeting*, 2016.