WILLIAM DEROCCO

derocco@umd.edu · deroc.co

ACADEMIC AND RESEARCH APPOINTMENTS

Dartmouth College, Hanover, NH; Sept. 2026–Sept. 2027 (fixed term)

Postdoctoral researcher (remote); PI: Prof. Elisabeth Newton

One-year position to build a pipeline to discriminate stellar flares from microlensing events in season one of Roman's Galactic Bulge Time Domain Survey.

University of Maryland/Johns Hopkins University, College Park, MD; Sept. 2024-present

Postdoctoral researcher (currently on hiatus); PIs: Profs. Raman Sundrum and Surjeet Rajendran

Joint postdoctoral researcher between theoretical physics groups at both institutions, working on astrophysical probes of new physics.

Santa Cruz Institute for Particle Physics, Santa Cruz, CA; Sept. 2021-Sept. 2024.
Postdoctoral researcher; sponsored by S. Profumo.

Stanford Institute for Theoretical Physics, Stanford, CA; Sept. 2016-Sept. 2021.
Graduate student; mentored by P. Graham.

Research Affiliations

NASA Goddard Space Flight Center, Greenbelt, MD — Sept. 2024–present

Research affiliation, Exoplanets and Stellar Astrophysics Laboratory (Code 667)

Collaborating with David Bennett and the microlensing group on preparations for the Nancy Grace Roman Space Telescope.

Visiting Appointments

KEK, Tsukuba, Japan — Visiting QUP researcher — Oct.–Nov. 2023

Host: V. Takhistov.

Earlier Research Experience

Yale University — Research intern; mentor: G. Fleming — 2015–2016

Fermilab — Research intern; mentor: B. Fleming — 2015

CERN — Research intern; mentors: T. Golling and T. Eifert — 2013–2015

EDUCATION

Stanford University — Ph.D. in Physics — 2021

Dissertation: "Novel astrophysical signatures of Beyond the Standard Model physics."

Advisor: Peter W. Graham.

Yale University — B.S. in Physics (Intensive), summa cum laude — 2016

RESEARCH LEADERSHIP

Chair, Roman Free-Floating Planet Working Group Sept. 2024–present

Roman Galactic Exoplanet Survey Project Infrastructure Team (RGES-PIT).

Leading the working group's search for free-floating planets with the Nancy Grace Roman Space Telescope.

GRANTS AND OBSERVING ALLOCATIONS

Grants — NASA Roman Cycle 1 General Investigator Program (selected)

Rogue Planets in Real Time.
Co-PI: W. DeRocco; PI: R. Street. $125,000 total, dedicated entirely to computational resources. Awarded for the development of RogueDB, a flexible event modeling and visualization database for free-floating planet demographics.

Rogue Worlds with Roman and Subaru/HSC.
PI: W. DeRocco. $450,000 total; full allocation supports my research. Awarded to enable pipeline development for Roman-Subaru synergies program.

The Missing Channels: N-body Population Synthesis of Free-Floating Planet Ejection Pathways for Roman GBTDS Interpretation.
Co-I: W. DeRocco; PI: J. Smallwood. $450,000 total; $25,000 allocated to my research to lead the development of a Bayesian reconstruction framework for free-floating planet origins.

Observational Programs

Roman/Subaru Synergy Observations.
Co-PI: W. DeRocco (with D. Suzuki). Awarded twenty nights on the Subaru telescope through the Roman-Subaru Synergies allocation to measure free-floating planet masses.

Flares Across the Spectrum.
Scientific co-lead with E. Newton. Arranged 25 days of PRIME observations during October–November 2026, contemporaneous with TESS, to study the near-infrared structure of stellar flares.

A Legacy Survey of Andromeda and Triangulum with Roman.
Co-Investigator (unfunded); PI: K. Gilbert. Selected Roman Cycle 1 General Astrophysics Survey, Program 2002.

HONORS AND AWARDS

Graduate Division Outstanding Postdoctoral Scholar Award,
University of California, Santa Cruz — June 2023. $1,500.

Achievement Rewards for College Scientists (ARCS) Scholar Award,
ARCS Foundation, Northern California Chapter — May 2020. $48,000.

Paul H. Kirkpatrick Award,
Stanford University — May 2020. Recognition for undergraduate physics teaching. $1,500.

Howard L. Schultz Award for senior thesis, Yale University 2016

"Show Me the Physics" video competition winner 2014
Foundational Questions Institute

TEACHING EXPERIENCE

PHYS499G: An Introduction to General Relativity, University of Maryland, College Park — January 2025 and January 2026.

Course creator and sole instructor. Designed and taught a three-week winter-session course for upper-level undergraduate physics majors, developing the curriculum and all instructional materials.

Sydney Spring School, Invited Lecturer, Sydney, Australia; Nov. 2022.

Delivered lectures to advanced graduate students on the overlap of stellar evolution and beyond the Standard Model Physics.

Teaching Assistant, Stanford University — April 2017–March 2020.
Led discussion sections and prepared instructional materials for undergraduate and graduate physics courses: Mechanics (PHYSICS 41), Electricity and Magnetism (PHYSICS 43), Mechanics and Special Relativity (PHYSICS 61), and General Relativity (PHYSICS 262).

RESEARCH MENTORING

Pierce Giffin — UC Santa Cruz; 2021–2024.
Served as a primary research mentor on dark-plasma physics and particle-in-cell simulations. Thesis advisor: Stefania Gori. Current position: Postdoctoral Research Associate, Princeton University.

Nolan Smyth — UC Santa Cruz; 2022–2024.
Served as a research co-mentor on microlensing alongside thesis advisor Stefano Profumo. Current position: Postdoctoral Researcher, Université de Montréal and Mila.

Edward Walsh — PhD student, University of Oklahoma; 2026–present.
Project mentor for research on free-floating planet production in tilted circumbinary systems. Thesis advisor: Jeremy Smallwood.

Polygence Mentor; March 2021-2023.
Mentored five motivated high-school students in advanced extracurricular projects of their choosing; project under my mentorship received first place at 3rd Biannual Symposium of Rising Scholars.

PROFESSIONAL SERVICE

Rogue Worlds 2026. (Cambridge, MA; Dec. 2026). Chair of the Scientific Organizing Committee. Upcoming meeting.

Rogue Worlds 2025. (Paris, France; Dec. 2025). Co-chair of the Scientific Organizing Committee.

Rogue Worlds 2024. (Osaka, Japan; Dec. 2024). Chair of the Scientific Organizing Committee.

Journal referee. Physical Review D and Physical Review Letters (2022, 2023); Journal of Cosmology and Astroparticle Physics (2023); The Astrophysical Journal, Astronomy & Astrophysics, Monthly Notices of the Royal Astronomical Society, and The Astronomical Journal (2025); The Astrophysical Journal Letters (2026).

OUTREACH AND ADVOCACY

Science on the Hill, Advocate, Washington, D.C.; Sep. 2025.

Led a delegation to meet with key congressional staffers and advocate for science-specific funding on Capitol Hill.

GRAD-MAP, Mentor, UMD, College Park; Jan. 2025.

Mentored undergraduate students from underserved institutions in one-week hands-on astronomy research program.

Santa Cruz Organization for Outreach in Physics, Founder and President — October 2021–August 2024.
Led initiatives to improve representation and public engagement in physics, including No Jargon Talks, a public-library Physics Book Club, and a dedicated campus space staffed by volunteer graduate mentors providing ongoing support to undergraduate physics students.

Future Advancers of Science and Technology, San Jose, CA; Aug. 2017-May 2020.

Volunteered at underserved high school as a mentor to students developing year-long science projects; projects completed under my mentorship won first place at regional science fairs in 2019 and 2020.

PUBLICATIONS

Publications preceded by an asterisk (*) are still under review.

Publications are organized by primary research focus into three areas: **Beyond the Standard Model Physics, General Astrophysics,** and **Planetary Science**. Within each area, papers are grouped by my research contribution, independently of author position. Author order follows the published articles, including alphabetical ordering where used. Shared first authorship is indicated explicitly.

Beyond the Standard Model Physics

Research led or co-led

1. **DeRocco, W.** (2025).
   Ganymede's subsurface ocean as a dark matter detector.
   Physical Review D, 112(11), 115023.

2. **DeRocco, W.** & Giffin, P. (2025).
   Dark plasmas in the nonlinear regime: Constraints from particle-in-cell simulations.
   Physical Review D, 111(9), 095031.

3. **DeRocco, W.**, Smyth, N., & Takhistov, V. (2024).
   New Light on Dark Extended Lenses with the Roman Space Telescope.
   The Astrophysical Journal Letters, 965(1), L3.

4. **DeRocco, W.**, Frangipane, E., Hamer, N., Profumo, S., & Smyth, N. (2024).
Revealing terrestrial-mass primordial black holes with the Nancy Grace Roman Space Telescope.
Physical Review D, 109(2), 023013.

5. **DeRocco, W.**, Wegsman, S., Grefenstette, B., Huang, J., & Van Tilburg, K. (2022).
First Indirect Detection Constraints on Axions in the Solar Basin.
Physical Review Letters, 129(10), 101101.

6. **DeRocco, W.**, Graham, P. W., & Kalia, S. (2021).
Warming up cold inflation.
Journal of Cosmology and Astroparticle Physics, 2021(11), 011.

7. **DeRocco, W.**, Graham, P. W., & Rajendran, S. (2020).
Exploring the robustness of stellar cooling constraints on light particles.
Physical Review D, 102(7), 075015.

8. Bollig, R., **DeRocco, W.**, Graham, P. W., & Janka, H.-T. (2020).
Muons in Supernovae: Implications for the Axion-Muon Coupling.
Physical Review Letters, 125(5), 051104. Erratum: Physical Review Letters, 126(18), 189901 (2021).

9. **DeRocco, W.** & Graham, P. W. (2019).
Constraining Primordial Black Hole Abundance with the Galactic 511 keV Line.
Physical Review Letters, 123(25), 251102.

10. **DeRocco, W.**, Graham, P. W., Kasen, D., Marques-Tavares, G., & Rajendran, S. (2019).
Supernova signals of light dark matter.
Physical Review D, 100(7), 075018.

11. **DeRocco, W.**, Graham, P. W., Kasen, D., Marques-Tavares, G., & Rajendran, S. (2019).
Observable signatures of dark photons from supernovae.
Journal of High Energy Physics, 2019(02), 171.

12. **DeRocco, W.** & Hook, A. (2018).
Axion interferometry.
Physical Review D, 98(3), 035021.

Other collaborative research

1. **DeRocco, W.**, Galanis, M., & Lasenby, R. (2022).
Dark matter scattering in astrophysical media: collective effects.
Journal of Cosmology and Astroparticle Physics, 2022(05), 015.

2. Baum, S., **DeRocco, W.**, Edwards, T. D. P., & Kalia, S. (2021).
Galactic geology: Probing time-varying dark matter signals with paleodetectors.
Physical Review D, 104(12), 123015.

3. Baracchini, E., **DeRocco, W.**, & Dho, G. (2020).
Discovering supernova-produced dark matter with directional detectors.
Physical Review D, 102(7), 075036.

General Astrophysics

Research led or co-led

1. *Liu, Z., **DeRocco, W.**, Gu, S., Khabiboulline, E. T., Choi, S., Childs, A. M., Hook, A., Gorshkov, A. V., & Gottesman, D. (2025).
   Measuring gravitational lensing time delays with quantum information processing.
   Physical Review X (under review).

2. **DeRocco, W.** & Dror, J. A. (2024).
   Using Pulsar Parameter Drifts to Detect Subnanohertz Gravitational Waves.
   Physical Review Letters, 132(10), 101403.

3. **DeRocco, W.** & Dror, J. A. (2023).
   Searching for stochastic gravitational waves below a nanohertz.
   Physical Review D, 108(10), 103011.

Other collaborative research

1. Zheng, Q., Mingarelli, C. M. F., **DeRocco, W.**, Nay, J., Boddy, K. K., & Dror, J. A. (2026).
   Probing picohertz gravitational waves with pulsars.
   Physical Review D, 113(2), 023037.

Conference proceedings

1. Chahine, Y. K., Cui, C., **DeRocco, W.**, et al. (2026).
   Eliminating photon transport in long-baseline optical interferometry using quantum memories.
   Proceedings of SPIE, 14148. doi:10.1117/12.3105495.

Planetary Science

Research led or co-led

1. ***DeRocco, W.**, Mordasini, C., Burn, R., Schib, O., & Blackman, J. (2026).
   Population synthesis models indicate habitable rogue planets may be abundant in the Galaxy.
   Nature Communications (under review).

2. Rice, M., **DeRocco, W.**, & Raymond, S. N. (2026).
   The Dynamics of Planetary Ejection.
   Publications of the Astronomical Society of the Pacific, 138(8), 082001.

3. Lee, E. J., **DeRocco, W.**, Hadden, S., & Gaudi, B. S. (2026).
   The Persistent Missing Mass Problem in Planet Formation.
   The Astrophysical Journal Letters, 1005(1), L18.

4. **DeRocco, W.**, Johnson, S. A., Zohrabi, F., Penny, M. T., & McGill, P. (2026).
Prospects for Reconstructing the Free-floating Planet Mass Function at the Population Level with the Nancy Grace Roman Space Telescope.
The Astronomical Journal, 172(1), 7.

5. Smallwood, J. L., **DeRocco, W.**, Qin, Z., & Sefilian, A. A. (2026).
The polar debris disc around 99 Herculis: a potential signpost for polar circumbinary planets.
Monthly Notices of the Royal Astronomical Society, 545(4), staf1982.

6. Kunimoto, M., **DeRocco, W. (Co-first author)**, Smyth, N., Bryson, S., & Gaudi, B. S. (2025).
Searching for Free-floating Planets with TESS: Results from Sectors 61–65.
The Astronomical Journal, 170(6), 321.

7. Coleman, G. A. L. & **DeRocco, W. (Co-first author)** (2025).
Predicting the Galactic population of free-floating planets from realistic initial conditions.
Monthly Notices of the Royal Astronomical Society, 537(3), 2303–2312.

8. **DeRocco, W.**, Smyth, N., & Profumo, S. (2024).
Constraints on sub-terrestrial free-floating planets from Subaru microlensing observations.
Monthly Notices of the Royal Astronomical Society, 527(3), 8921–8930.

Other collaborative research

1. Fernandes, R. B., Johnson, S., Bergsten, G. J., Bhure, S., Boley, K. M., Boss, A. P., Bryson, S., **DeRocco, W.**, et al. (2025).
Are We There Yet? Challenges in Quantifying the Frequency of Earth Analogs in the Habitable Zone.
Publications of the Astronomical Society of the Pacific, 137(12), 121001.

INVITED TALKS AND CONFERENCE PRESENTATIONS

Invited Plenary Speaker

1. International Conference on Exoplanets and Planet Formation. (Shanghai, China; Dec. 2025.)

Invited Seminars

1. Queen's University. (Kingston, Ontario; Oct. 2026.)
2. University of Oklahoma. (Norman, OK; May 2026.)
3. University of Bern. (Bern, Switzerland; Feb. 2026.)
4. Perimeter Institute. (Waterloo, Ontario; Oct. 2025.)
5. New York University. (New York, NY; Aug. 2025.)
6. Trottier Space Institute. (Montreal, Quebec; Aug. 2025.)
7. University of Michigan. (Ann Arbor, MI; Nov. 2024.)
8. University of Oklahoma. (Norman, OK; Oct. 2024.)
9. University of Maryland. (College Park, MD; Oct. 2024.)

10. University of Sydney. (Sydney, Australia; March 2024.)
11. University of Melbourne. (Melbourne, Australia; March 2024.)
12. University of Maryland. (College Park, MD; Dec. 2023.)
13. University of California, San Diego. (San Diego, CA; Dec. 2023.)
14. Johns Hopkins University. (Baltimore, MD; Nov. 2023.)
15. Kavli Institute for the Physics and Mathematics of the Universe. (Kashiwa, Japan; Oct. 2023.)
16. KEK Theory Seminar. (Tsukuba, Japan; Oct. 2023.)
17. Stanford Institute for Theoretical Physics. (Stanford, CA; Oct. 2023.)
18. Institut de Physique Theorique, Saclay. (Saclay, France; Sept. 2023.)
19. Jeonbuk National University. (Jeonju, Korea; June 2023).
20. Fermi National Accelerator Laboratory. (Batavia, IL; Feb. 2023).
21. Perimeter Institute. (Waterloo, Canada; Jan. 2023.)
22. Santa Cruz Institute of Particle Physics. (Santa Cruz, CA; Feb. 2022.)
23. Johns Hopkins University. (Baltimore, MD; Nov. 2021.)
24. University of California, Berkeley. (Berkeley, CA; Sept. 2021.)
25. BSM Pandemic Conference Series. (Virtual; Nov. 2020.)
26. University of California, Los Angeles. (Los Angeles, CA; Oct. 2020.)
27. IBS-ICTP Workshop on Axion-Like Particles. (Daejeon, Korea; Oct. 2020.)
28. Virginia Tech Center for Neutrino Physics. (Blacksburg, VA; July 2020.)
29. Perimeter Institute. (Waterloo, Canada; July 2020.)
30. University of California, Berkeley. (Berkeley, CA; Nov. 2019.)

Other conference and workshop presentations

1. Dark Matter and Stars. (Southampton, UK; July 2026.)
2. Empowering Science in the Era of Data-Rich Astronomy. (Tucson, AZ; April 2026.)
3. 28th International Microlensing Conference. (Heidelberg, Germany; Feb. 2026.)
4. Dark Side of the Universe. (Montreal, Quebec; July 2025.)
5. AAS Division on Dynamical Astronomy Annual Meeting. (Atlanta, GA; May 2025).
6. How Roman Observations Will Confront Theory. (Pasadena, CA; July 2024.)
7. Exoplanets 5. (Leiden, Netherlands; June 2024.)
8. SEEC Symposium: Pathways to Non-Transiting Planets. (Greenbelt, MD; Apr. 2024).
9. Extreme Solar Systems V. (Christchurch, New Zealand; March 2024.)
10. KEK Workshop of Particle Phenomenology. (Tsukuba, Japan; Nov. 2023.)
11. 5th New Physics Korea Institute. (Busan, Korea; June 2023.)
12. 16th International Conference on Particle Physics and Cosmology. (Daejeon, Korea; June 2023.)

13. UCLA Dark Matter Conference. (Los Angeles, California; March 2023.)
14. 16th International Workshop on the Dark Side of the Universe. (Sydney, Australia; Dec. 2022.)
15. Dark Matter in Compact Objects Workshop. (Seattle, WA; Aug. 2022).
16. 14th International Conference on the Identification of Dark Matter. (Vienna, Austria; July 2022.)
17. Towards the Next Fundamental Scale of Nature Workshop. (Mainz, Germany; July 2022).
18. 24th Conference From the Planck Scale to the Electroweak Scale. (Paris, France; June 2022).
19. Feebly-Interacting Sectors Impact on Cosmology and Astrophysics. (Virtual. Feb. 2022.)
20. 24th Conference on Particle Physics and Cosmology. (Urbana-Champaign, IL; Aug. 2021.)
21. European Physical Society Conference on High Energy Physics. (Hamburg, Germany; July 2021.)
22. Phenomenology 2021. (Pittsburgh, PA; June 2021.)
23. 16th Conference on Topics in Astroparticle and Underground Physics. (Toyama, Japan; Sept. 2019.)
24. CYGNUS Workshop on Directional Dark Matter Detection. (Rome, Italy; June 2019.)
25. Invisibles Workshop on Neutrinos, Dark Matter, and Dark Energy. (Valencia, Spain; June 2019.)
26. 15th Patras Workshop on Axions, WIMPs, and WISPs. (Freiburg, Germany; June 2019.)