

WILLIAM DEROCCO

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EDUCATION

Stanford University, Stanford, CA; September 2016-September 2021.

Ph.D. in Physics • GPA: 4.05

Thesis: “Novel astrophysical signatures of Beyond the Standard Model physics.”

Yale University, New Haven, CT; September 2012-May 2016

Bachelor of Science in Physics (Intensive) • GPA: 3.99 • Graduated summa cum laude

Awards: Howard L. Schultz Award for senior thesis (2016), Foundational Questions Institute “Show Me the Physics” video competition winner (2014)

CURRENT RESEARCH POSITIONS

University of Maryland/Johns Hopkins University, College Park, MD; Sept. 2024-present
Postdoctoral researcher; sponsored by Raman Sundrum, Ph.D. and Surjeet Rajendran, Ph.D.

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

NASA Goddard Spaceflight Center, Greenbelt, MD; Sept. 2024-present

External contractor; sponsored by David Bennett, Ph.D.

Spearheading the initiative to search for free-floating planets with the upcoming Nancy Grace Roman Space Telescope for the Roman Galactic Exoplanet Survey Project Infrastructure Team.

PREVIOUSLY HELD POSITIONS

High Energy Accelerator Research Organization, Tsukuba, Japan; Oct. 2023-Nov. 2023
QUP intern; invited by V. Takhistov, Ph.D.

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

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

Yale University Physics Department, New Haven, CT; Sept. 2015-May 2016
Intern; mentored by G. Fleming, Ph.D.

Fermi National Accelerator Laboratory, Batavia, IL; June 2015-Sept. 2015
Intern; mentored by B. Fleming, Ph.D.

CERN, Geneva, Switzerland; June 2013-May 2015
Intern; mentored by T. Golling, Ph.D. and T. Eifert, Ph.D.

FELLOWSHIPS

Achievement Rewards for College Scientists (ARCS) Scholar Award; May 2020
Graduate fellow

Awarded by the Northern California chapter of the ARCS Foundation to senior graduate students with a record of past achievement and who show exceptional promise of making significant contributions to the scientific strength of the nation. Provides \$48,000, full funding for the 2020-2021 academic year.

AWARDS & HONORS

Graduate Division Outstanding Postdoctoral Scholar Award; June 2023.

Awarded to a postdoctoral scholar at the University of California, Santa Cruz for demonstrating a strong original research program, leadership ability, effective mentorship of graduate students, and a commitment to outreach. \$1500.

Paul H. Kirkpatrick Award; May 2020.

Awarded to a graduate student in the Stanford Physics Department for demonstrating a talent for and commitment to the teaching of physics to undergraduates. \$1500.

TEACHING/MENTORING/OUTREACH

Santa Cruz Organization for Outreach in Physics, President; Oct. 2021-Aug. 2024.

Founded organization; lead outreach initiatives targeted at improving diversity, equity, and inclusion within physics.

Santa Cruz Public Library Physics Book Club, Leader, Santa Cruz, CA; Apr. 2023-present.

Lead discussion among 28-person group, highlight recent discoveries in physics.

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.

Polygence Mentor; March 2021-present. Mentored motivated high-school students in advanced extracurricular projects of their choosing. Past projects include:

- "Time dilation effects near stellar-mass black holes." *With Shivani M., New Jersey. 2023*
- "Hunting for black holes with gravitational lensing." *With Jax P., New Zealand. 2022.*
- "Improving data poisoning techniques in image classification." *With Aditya M., California. 2021. Received 3rd place award at 6th Symposium of Rising Scholars.*
- "A handbook for dark matter hunters." *With Grant L., California. 2021.*
- "Simulating Zipfian critical points in generic systems." *With William P., California. 2021.*

Teaching Assistant, Stanford University; Apr. 2017-March 2020.

- *PHYSICS 43: Electricity and Magnetism.* Taught by M. Kasevich. Spr. 2017, Spr. 2018.
- *PHYSICS 61: Mechanics and Special Relativity.* Taught by P. Burchat. Aut. 2017.
- *PHYSICS 262: General Relativity.* Taught by P. Graham. Aut. 2018, Aut. 2019.
- *PHYSICS 41: Mechanics.* Taught by Y. Lee. Win. 2019, Win. 2020.

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.

Physics Equity and Inclusion Committee, Stanford, CA; Sept. 2017-May 2018.

Led Graduate Action Committee, organizing community meetings to improve the graduate experience. Topics included graduate admissions, improving diversity, and establishing best practices at department seminars.

PUBLICATIONS

Note: Author names are often listed in alphabetical order. I was primary author on starred publications below.

Refereed

1. **DeRocco, W.***, Smyth, N., & Takhistov, V. (2023). New light on dark extended lenses with the Roman Space Telescope. *Astrophysical Journal Letters*, 965(1), L3. Led analysis, implemented extended lens functionality in existing codebase.
2. **DeRocco, W.***, Frangipane, E., Hamer, N., Profumo, S., & Smyth, N. (2023). Revealing terrestrial-mass primordial black holes with the Nancy Grace Roman Space Telescope. *Physical Review D*, 109(2), 023013. Originated idea, led project, mentored three graduate students, wrote manuscript.
3. **DeRocco, W.***, Smyth, N., & Profumo, S. (2023). Constraints on sub-terrestrial free-floating planets from Subaru microlensing observations. *Monthly Notices of the Royal Astronomical Society*, 527(3), 8921-30. Led project, wrote manuscript.
4. **DeRocco, W.*** & Dror, J. (2022). Using pulsar parameter drifts to detect sub-nanohertz gravitational waves. *Physical Review Letters*, to appear. Equal contributor to analysis.
5. **DeRocco, W.*** & Dror, J. (2023). Searching for stochastic gravitational waves below a nanohertz. *Physical Review D*, 108(10), 103011. Equal contributor to analysis.
6. **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. Processed and analyzed NuSTAR data, wrote majority of manuscript.
7. **DeRocco, W.**, Galanis, M., & Lasenby, R. (2022). Dark matter scattering in astrophysical media: collective effects. *Journal of Cosmology and Astrophysics*, 2022(05), 015.
8. **DeRocco, W.***, Graham, P. W., & Kalia, S. (2021). Warming up cold inflation. *Journal of Cosmology and Astrophysics*, 2021(11), 11. Led project, wrote majority of manuscript.
9. Baum, S., **DeRocco, W.**, Edwards, T. E., & Kaalia, S. (2021). Galactic geology: Probing time-varying dark matter signals with paleo-detectors. *Physical Review D*, 104(12), 123015. Originated idea, performed simulation of Earth's trajectory through Galaxy.
10. Baracchini, E., **DeRocco, W.***, & Dho, G. (2020). Discovering supernova-produced dark matter in directional detectors. *Physical Review D*, 102(7), 075036. Advised on theoretical motivation, wrote portion of manuscript.
11. **DeRocco, W.***, Graham, P. W., & Rajendran, S. (2020). Exploring the robustness of stellar cooling constraints on light particles. *Physical Review D* 102(7), 075015. Performed entire analysis, wrote manuscript.
12. 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. Led project, processed simulation output, performed analysis, wrote majority of manuscript.
13. **DeRocco, W.***, & Graham, P. W. (2019). Constraining primordial black hole abundance with the Galactic 511 keV line. *Physical Review Letters*, 123(25), 251102. Performed entire analysis, wrote manuscript.
14. **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. Wrote code to compute observables given supernova profiles, wrote half of manuscript.
15. **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(2), 171. Wrote code to compute observables given supernova profiles.
16. **DeRocco, W.***, & Hook, A. (2018). Axion interferometry. *Physical Review D*, 98(3), 035021. Helped to originate idea, cross-validated results of collaborator.

Submitted

1. Coleman, G. and **DeRocco, W.** (2024). Predicting the population of free-floating planets from realistic initial conditions. *Monthly Notices of the Royal Astronomical Society*, upcoming.
2. Kunitomo, M., **DeRocco, W.**, Smyth, N., & Bryson, S. (2024). Searching for Free-Floating Planets with TESS: I. Results from a First Search of Sector 61. *Monthly Notices of the Royal Astronomical Society*, submitted.

PRESENTATIONS

Invited Seminars

1. *University of Michigan*. (Ann Arbor, MI; Nov. 2024.)
“Exploring the dark side with high-cadence microlensing.”
2. *University of Oklahoma*. (Norman, OK; Oct. 2024.)
“Exploring the dark side with high-cadence microlensing.”
3. *University of Maryland*. (College Park, MD; Oct. 2024.)
“A shock in the dark: plasma instabilities in the dark sector.”
4. *University of Sydney*. (Sydney, Australia; March 2024.)
“Exploring the dark side with high-cadence microlensing.”
5. *University of Melbourne*. (Melbourne, Australia; March 2024.)
“Exploring the dark side with high-cadence microlensing.”
6. *University of Maryland*. (College Park, MD; Dec. 2023.)
“Exploring the dark side with high-cadence microlensing.”
7. *University of California, San Diego*. (San Diego, CA; Dec. 2023.)
“Exploring the dark side with high-cadence microlensing.”
8. *Johns Hopkins University*. (Baltimore, MD; Nov. 2023.)
“Exploring the dark side with high-cadence microlensing.”
9. *Kavli Institute for the Physics and Mathematics of the Universe*. (Kashiwa, Japan; Oct. 2023.)
“Exploring the dark side with high-cadence microlensing.”
10. *KEK Theory Seminar*. (Tsukuba, Japan; Oct. 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
11. *Stanford Institute for Theoretical Physics*. (Stanford, CA; Oct. 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
12. *Institut de Physique Theorique, Saclay*. (Saclay, France; Sept. 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
13. *Jeonbuk National University*. (Jeonju, Korea; June 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
14. *Fermi National Accelerator Laboratory*. (Batavia, IL; Feb. 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
15. *Perimeter Institute*. (Waterloo, Canada; Jan. 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
16. *Santa Cruz Institute of Particle Physics*. (Santa Cruz, CA; Feb. 2022.)
“Hunting for axions in the solar basin.”
17. *Johns Hopkins University*. (Baltimore, MD; Nov. 2021.)
“Hunting for axions in the solar basin.”
18. *University of California, Berkeley*. (Berkeley, CA; Sept. 2021.)
“Hunting for axions in the solar basin.”
19. *BSM Pandemic Conference Series*. (Virtual; Nov. 2020.)
“Muons in supernovae: implications for the axion-muon coupling.”
20. *University of California, Los Angeles*. (Los Angeles, CA; Oct. 2020.)
“Muons in supernovae: implications for the axion-muon coupling.”
21. *IBS-ICTP Workshop on Axion-Like Particles*. (Daejeon, Korea; Oct. 2020.)
“Muons in supernovae: implications for the axion-muon coupling.”
22. *Virginia Tech Center for Neutrino Physics*. (Blacksburg, VA; July 2020.)
“Muons in supernovae: implications for the axion-muon coupling.”
23. *Perimeter Institute*. (Waterloo, Canada; July 2020.)
“Recent insights on SN1987a: implications for BSM phenomenology.”
24. *University of California, Berkeley*. (Berkeley, CA; Nov. 2019.)
“Observing the dark sector with supernovae.”

Conferences and workshops

1. *How Roman Observations Will Confront Theory*. (Pasadena, CA; July 2024.)
“Reconstructing the free-floating planet mass function with Roman.”
2. *Exoplanets 5*. (Leiden, Netherlands; June 2024.)

- “Making a MESS out of TESS: searching for microlensing by free-floating planets with TESS.”
3. *SEEC Symposium: Pathways to Non-Transiting Planets*. (Greenbelt, MD; Apr. 2024).
“Making a MESS out of TESS: searching for microlensing by free-floating planets with TESS.”
 4. *Extreme Solar Systems V*. (Christchurch, New Zealand; March 2024.)
“Making a MESS out of TESS: searching for microlensing by free-floating planets with TESS.”
 5. *KEK Workshop of Particle Phenomenology*. (Tsukuba, Japan; Nov. 2023.)
“Exploring the dark side with high-cadence microlensing.”
 6. *5th New Physics Korea Institute*. (Busan, Korea; June 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
 7. *16th International Conference on Particle Physics and Cosmology*. (Daejeon, Korea; June 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
 8. *UCLA Dark Matter Conference*. (Los Angeles, California; March 2023.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
 9. *16th International Workshop on the Dark Side of the Universe*. (Sydney, Australia; Dec. 2022.)
“Extending pulsar timing sensitivity to the ultralow frequency regime.”
 10. *Dark Matter in Compact Objects Workshop*. (Seattle, WA; Aug. 2022).
“Hunting for axions in the solar basin.”
 11. *14th International Conference on the Identification of Dark Matter*. (Vienna, Austria; July 2022.)
“Hunting for axions in the solar basin.”
 12. *Towards the Next Fundamental Scale of Nature Workshop*. (Mainz, Germany; July 2022).
“Hunting for axions in the solar basin.”
 13. *24th Conference From the Planck Scale to the Electroweak Scale*. (Paris, France; June 2022).
“Hunting for axions in the solar basin.”
 14. *Feebly-Interacting Sectors Impact on Cosmology and Astrophysics*. (Virtual. Feb. 2022.)
“Hunting for axions in the solar basin.”
 15. *24th Conference on Particle Physics and Cosmology*. (Urbana-Champaign, IL; Aug. 2021.)
“Hunting for axions in the solar basin.”
 16. *European Physical Society Conference on High Energy Physics*. (Hamburg, Germany; July 2021.)
“Supernova signals of light dark matter in directional detectors.”
 17. *Phenomenology 2021*. (Pittsburgh, PA; June 2021.)
“Hunting for axions in the solar basin.” Presented at
 18. *16th Conference on Topics in Astroparticle and Underground Physics*. (Toyama, Japan; Sept. 2019.)
“Observing the dark sector with supernovae.”
 19. *CYGNUS Workshop on Directional Dark Matter Detection*. (Rome, Italy; June 2019.)
“Supernova signals of light dark matter in directional detectors.”
 20. *Invisibles Workshop on Neutrinos, Dark Matter, and Dark Energy*. (Valencia, Spain; June 2019.)
“Observable signatures of dark photons from supernovae.”
 21. *15th Patras Workshop on Axions, WIMPs, and WISPs*. (Freiburg, Germany; June 2019.)
“Observing the dark sector with supernovae.”