Marina M. Dunn

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Education

Ph.D. in Astrophysics - University of La Laguna/Instituto de Astrofísica de Canarias (IAC) **Expected 2027**
Thesis: *"Deep Learning for Galaxy Structure and Morphology from Massive Datasets"*

Master of Science in Engineering: Data Science - University of California, Riverside **June 2023**
Thesis: *"Galaxy Morphology Classification Using Bayesian Neural Networks for the Legacy Survey of Space and Time (LSST)"*
Distinctions: *2024 Presidential Management Fellow Semi-finalist, UCR Bourns College of Engineering Commencement Graduate Student Marshal (2023), UCR Grad Slam Finalist (2023)*
Honors & Awards: *SWE Wanda Munn Scholarship (2023, offered), American Astronomical Society FAMOUS Travel Grant (2023), SWE WE Local Collegiate Competition Finalist (2022), 2022 AnitaB.org Grace Hopper Celebration Student Scholar, SWE WE22 Conference Grant, Uncertainty Quantification for Machine Learning Integrated Physics Modeling Travel Award (2022, NSF/Sandia Laboratories)*

Bachelor of Science in Astronomy - University of Arizona **May 2018**
Honors & Awards: *Honors Alumni Legacy Grant (2016), Arizona Excellence Scholarship (2014), Angelos C. Langadas Scholarship (2017)*

Professional Skills

Programming: Python, R, MATLAB, HTML, C, LaTeX, Markdown

Libraries: TensorFlow, Keras, PyTorch, scikit-learn, Numpy, Pandas, Matplotlib, Plotly, SciPy, OpenCV, PySpark

Version Control: Git/GitHub/GitLab; **IDEs/Editors:** Jupyter, Visual Studio Code, R Studio, Vim

Other: Telescope Operations, Web Design & Development, STEM Outreach, Digital Art, Technical Troubleshooting & Repairs

Research Experience

Ph.D. Candidate, EDUCADO Doctoral Network — October 2024 - Present

• Researching the morphologies of low-mass galaxies, with a specific focus on developing deep learning algorithms and incorporating Bayesian Neural Networks, and applying these to data obtained from Euclid and LSST surveys.

Graduate Researcher, Deep Skies Lab/University of California, Riverside — September 2021 - June 2023

• Investigated application of Bayesian Neural Networks and transfer learning methods to classify galaxy morphologies in simulated imaging dataset representing different observing years with LSST, exploring the impact of observational realism on model performance.

CRESST II Research Assistant, NASA Goddard Space Flight Center — January 2023 - December 2023

Project: "Detection and Segmentation of Ice Blocks in Europa's Chaos Regions Using Deep Learning"

• Led research developing an advanced deep learning approach for identifying and tracking individual ice blocks within the intricate "chaos terrain" regions of Jupiter's moon, Europa, in order to enhance our understanding of geophysical properties and processes, and provide crucial insights for future mission planning.

Data Science Graduate Intern, NASA Langley Research Center — August 2022 - December 2022

Project: "The Machine Learning (ML) Showroom"

• Designed and developed components empowering NASA teams to learn about machine learning and evaluate its use for their research.

• Engineered interactive, cloud-based coding notebooks with simplified ML models using scikit-learn, TensorFlow, PyTorch, etc., an internal Microsoft SharePoint site housing educational resources and a dedicated forum for inquiries and feedback.

• Effectively alleviated complexity and reluctance toward ML, accelerating its adoption across the agency.

Computing Scholar, Data Science Summer Institute, Lawrence Livermore National Laboratory — May 2022 - August 2022

Projects: "Visualizing Model Optimization for Orbital Debris Characterization," "Machine Learning Methods to Screen Compounds Targeting COVID-19"

• Developed visualization tools for optimizing Gaussian process models, such as "MuyGPs," used to predict observation gaps in orbital debris tracking applications.

• Simultaneously, researched various machine learning approaches, leveraging molecular descriptors and 3D atomic representations, to screen drug-like compounds targeting SARS-CoV-2 (COVID-19) to identify those with the potential to effectively treat or prevent the virus.

Graduate Intern, NASA Goddard Space Flight Center — August 2021 - May 2022

Projects: "Optimizing Data Formats for Earth Information System Fire Portal", "Cloud-Optimized Tools for the Surface Biology & Geology High-Frequency Time Series Campaign"

• Conducted research focused on optimizing the migration and storage of NASA Earth Science data and models in commercial cloud environments.

• Developed enhanced, interactive, and cloud-optimized analysis-ready dashboards, specifically tailored to various datasets, including those related to wildfire emissions.

- Engineered data pipeline adhering to NASA STAC Catalog specifications, facilitating data processing for the NASA SHIFT AVIRIS-NG hyper-spectral vegetation campaign.

Undergraduate Researcher, University of Arizona August 2014 - May 2018

Projects: TeraHertz Space Telescope, NASA GUSTO, Seismometer to Investigate Ice and Ocean Structure (SIIOS), "Submillimeter Spectroscopy of the R Coronae Australis Molecular Cloud Region", "Radio Astronomy Project," "The University of Arizona Exoplanet Project"

- Authored comprehensive proposals, designed, constructed, and tested antenna prototypes, managed associated budgets, secured crucial institutional letters of intent, orchestrated and facilitated critical meetings and site visits, and presented preliminary findings for several key missions.
- Performed detailed analysis of sub-millimeter astronomy data, utilizing Python to generate intricate visual mappings of gas flows within giant gas clouds. Provided vital insights into internal dynamics of these clouds, and confirmed active star formation processes.
- Conducted observational studies of dark, dense gas clouds using the 12-meter Arizona Radio Observatory Telescope on Kitt Peak, AZ, throughout the academic year. Employed radiative transfer models to determine which are promising candidates for future star formation.
- Conducted comprehensive observations of transiting exoplanets utilizing the Kuiper 61" Telescope on Mt. Bigelow, AZ. Employed a multi-wavelength approach to analyze observational data and discern the composition of their atmospheres. Investigated various data reduction techniques, including the incorporation of brighter nearby reference stars, to enhance the revelation of atmospheric characteristics.

Additional Work Experience

Data Science Engineer, Apple Inc. (January 2021 - June 2021)

Strategic Data Solutions Team (6-month Program)

- Developed a Python-based data pipeline utilizing web APIs to identify & track "high risk/priority" customers, effectively mitigating unwarranted personal information access.

Software Engineer, Apple Inc. (January 2020 - July 2020)

Data Engineering Team, Data Analytics (7-month Program)

- Developed code utilizing Apache Spark, Python & SQL to provide iOS device analytics, enhancing business-critical reporting capabilities.

Technical Expert, Apple Inc. (October 2019 - August 2021)

Technical Specialist, Apple Inc. (October 2018 - July 2019)

Apple Certified iOS Technician (ACiT) - Issued July 2019

- Resolved complex technical issues through software troubleshooting and hardware repairs, while delivering exceptional customer service and maintaining adaptability in a dynamic environment.

Instructional Specialist, University of Arizona (June 2015, June 2018, June 2019)

- Managed operations and care, facilitated telescope observing sessions, and developed and delivered educational STEM content for students during week-long annual Astronomy Camp on remote mountaintop observatories.

Chief Telescope Operator, University of Arizona (August 2014 - May 2018)

- Directed operations for Steward Observatory's on-campus telescopes, overseeing multiple observational instruments.
- Organized public outreach events, fostering community engagement.
- Supervised a team of student operators.
- Collaborated with professors, supporting general education astronomy courses by assisting with tasks and guiding students in targeted celestial observations for coursework.

Publications

First Author:

Dunn, M. M., Mills, A. C., Duncan, E. J., Awadallah, A., Santerre, J., Trent, D. M., Larsen, A., & Nixon, C. A. (2023, December 15). Detection and Segmentation of Ice Blocks in Europa's Chaos Regions Using Mask R-CNN. *Machine Learning and the Physical Sciences Workshop*. 37th Conference on Neural Information Processing Systems (NeurIPS), New Orleans, Louisiana, USA. https://ml4physicalsciences.github.io/2023/files/NeurIPS_ML4PS_2023_156.pdf

Collaboration:

Euclid Collaboration, Corcho-Caballero, P., Ascasibar, Y., Kleijn, G. V., Lovell, C. C., De Lucia, G., Cleland, C., Fontanot, F., Tortora, C., Koopmans, L. V. E., Eales, S., Moutard, T., Laigle, C., Nersesian, A., Shankar, Dunn, M., F., Aghanim, N., Altieri, B., Amara, A., Andreon, S., Aussel, H., … Sorce, J. G. (2025). *Euclid Quick Data Release (Q1). A probabilistic classification of quenched galaxies* (Version 1). arXiv. https://doi.org/10.48550/ARXIV.2503.15315

Euclid Collaboration, Siudek, M., Huertas-Company, M., Smith, M., Martinez-Solaeche, G., Lanusse, F., Ho, S., Angeloudi, E., Cunha, P. A. C., Sánchez, H. D., Dunn, M., Fu, Y., Iglesias-Navarro, P., Junais, J., Knapen, J. H., Laloux, B., Mezcua, M., Roster, W., Stevens, G., … Sorce, J. G. (2025). *Euclid Quick Data Release (Q1) Exploring galaxy properties with a multi-modal foundation model* (Version 1). arXiv. https://doi.org/10.48550/ARXIV.2503.15312

Nguyen, D. M. T., Cortes, J. C., Dunn, M. M., & Shiklomanov, A. N. (2023). *Impact of Chunk Size on Read Performance of Zarr Data in Cloud-based Object Stores* (Earth and Space Science essoar.10511054.2). ESS Open Archive. https://doi.org/10.1002/essoar.10511054.2

J. K. Calahan et al. (2018). Searching for Inflow toward Massive Starless Clump Candidates Identified in the Bolocam Galactic Plane Survey. *The Astrophysical Journal*, *862*(1), 63. https://doi.org/10.3847/1538-4357/aabfea

Conference Proceedings

Dunn, M., Knapen, J., Huertas-Company, M., Pandya, V. (2025, September 3). *Inferring the 3D Shapes of Euclid Q1 Galaxies* [Poster presentation]. Open SkAI 2025, Chicago, Illinois, USA.

Dunn, M. (2025, January 29). *Inferring the 3D Shapes of Euclid Q1 Galaxies* [Flash Talk]. Euclid Joint Local Universe, Galaxy Evolution and Primeval Universe Science Working Groups Meeting, La Laguna, Tenerife, Spain.

Dunn, M. M., Mills, A. C., Awadallah, A., Duncan, E. J., Trent, D. M., Larsen, A., Santerre, J. & Nixon, C. A. (2023, December 15). *Detection and Segmentation of Ice Blocks in Europa's Chaos Regions Using Mask R-CNN* [Poster presentation]. *Machine Learning and the Physical Sciences Workshop.* 37th Conference on Neural Information Processing Systems (NeurIPS), New Orleans, Louisiana, USA. https://nips.cc/media/PosterPDFs/NeurIPS%202023/76196.png

Dunn, M. M., Nixon, C. A., Duncan, E. J., Mills, A. C., Santerre, J., Trent, D. M., Larsen, A., Neidel, I., & Yahn, Z. (2023, May 2-3). *Detection and Segmentation of Ice Blocks in Europa's Chaos Regions Using Deep Learning* [Conference presentation]. 2023 Outer Planets Assessment Group Meeting, John Hopkins University, Laurel, MD, USA. https://ui.adsabs.harvard.edu/abs/2023LPICo2992.6005D

Dunn, M., Ćiprijanović, A., Nord, B., & Mobasher, B. (2023, January 8-12). *Galaxy Morphology Classification Using Bayesian Neural Networks for LSST* [Poster session]. 241st American Astronomical Society Meeting, Seattle, WA, USA. https://ui.adsabs.harvard.edu/abs/2023AAS...24110513D

Dunn, M. , Na, D., & Trent, D. M. (2022, November 15-17). *The Machine Learning Showroom* [Conference presentation]. 2022 NASA Data Science Summit, NASA Langley Research Center, Hampton, VA, USA.

M. M. Dunn et al. (2017, January 3-7). *TeraHertz Space Telescope (TST)* [Poster session]. 229th American Astronomical Society Meeting, Grapevine, TX, USA. https://ui.adsabs.harvard.edu/abs/2017AAS...22923830D

M. Ryleigh Fitzpatrick et al. (2016, January 3-8). *A Study of the Effects of Underlying Assumptions in the Reduction of Multi-Object Photometry of Transiting Exoplanets* [Poster session]. 227th American Astronomical Society Meeting, Kissimmee, FL, USA. https://ui.adsabs.harvard.edu/abs/2016AAS...22713807R

Invited Talks* and Presentations

*Panelist, *UCR Graduate Student Panel*, UCR Graduate Division Open House, Virtual, October 18, 2023.

Dunn, M., Fletcher, L., Cardenas, M. S., & Stephany, R. (2022, August 9). *DSSI Challenge Problem: Machine Learning Methods to Screen Compounds Targeting COVID-19* [PowerPoint slides]. Data Science Summer Institute, Lawrence Livermore National Laboratory.

Dunn, M. (2022, August 4). *Visualizing Model Optimization for Orbital Debris Characterization* [PowerPoint slides]. Data Science Summer Institute, Lawrence Livermore National Laboratory. https://youtu.be/Ru11sTYCk98

Dunn, M., Chazaro Cortes, J., & Nguyen, D. M. (2022, May 9). *Cloud-Optimized Tools for the Surface Biology & Geology High-Frequency Time Series Campaign* [Poster presentation]. NASA Goddard Space Flight Center.

*Panelist, *Data Reconstruction: AI/ML's Place in NASA's Future*, NASA Langley Research Center, Virtual, November 29, 2022.

*Panelist, *Gap Year Planning*, University of Arizona Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP), Virtual/Tucson, AZ, February 16, 2022.

Dunn, M., Chazaro Cortes, J., & Nguyen, D. M. (2021, December 8). *Optimizing Data Formats for Earth Information System Fire Portal* [PowerPoint slides]. NASA Goddard Space Flight Center.

*Panelist, *Gap Year Planning and Industry* Careers, University of Arizona Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP), Virtual/Tucson, AZ, February 5, 2020.

*Panelist, *Navigating the First Two Years of Physics/Astronomy Programs*, University of Arizona Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP), Tucson, AZ, September 6, 2017.

Professional Service

EDUCADO Doctoral Network

Supervisory Board Doctoral Candidate Chair — *February 2025 - Present*

Training Committee Doctoral Candidate Representative — *October 2024 - February 2025*

Science and Local Organizing Committee (SLOC), EDUCADO 2025 Annual & Mid-Term Meeting — *November 2024 - January 2025*

Local Organizing Committee (LOC), EDUCADO Second Training School in Tenerife — *January - June 2025*

University of Arizona Astronomy Club — **August 2014 - May 2018**

President — *2017 - 2018*

Outreach Coordinator — *2016 - 2017*

- Curated engaging weekly content for undergraduate students, organized club meetings, fundraisers, and research opportunities
- Organized 300+ free telescope viewings & STEM activities at local school events, strengthening community impact

- Established free Astronomy Tutoring of Majors & Minors (ATOMM) program to support students in upper-division astrophysics classes

TIMESTEP Student Leader, University of Arizona **August 2015 - May 2018**

- Led panels and discussion groups, coordinated hands-on workshops for Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP) focused on STEM topics such as successfully navigating academic degrees, careers in industry and government, retaining underrepresented individuals, battling persistent stereotypes, developing professional skills to achieve career goals, challenges faced by marginalized groups and how to be a better advocate.

Professional Memberships/Affiliations

Member, Academic Data Science Alliance (ADSA)
Member, American Astronomical Society (AAS)
Member, Association for Computing Machinery (ACM)
Member, Deep Skies Lab
Member, Graduate Women in Science (GWIS)
Member, Girls in Tech
Member, Out in STEM (oSTEM)
Member, Society of Women Engineers (SWE)
Member, Rubin Observatory LSST Science Collaborations (Informatics & Statistics, Galaxies)