Marina M. Dunn

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Profile

Enthusiastic, highly motivated & determined Data Science M.S. recent graduate specializing in ML/deep learning applications for data-driven astrophysics research. Experience in industry, government, and academia. Passionate about STEM outreach & advocacy.

Education

M.S. Engineering: Data Science **JUNE 2023**

University of California, Riverside

Advisor: *Dr. Bahram Mobasher (UCR);* ***Research Mentors:*** *Dr. Aleksandra Ćiprijanović & Dr. Brian Nord (Deep Skies Lab, Fermilab U. Of Chicago)*

Thesis Project: *"Galaxy Morphology Classification Using Bayesian Neural Networks for the Legacy Survey of Space and Time (LSST)"*

Relevant Coursework*: Data Science, Statistical Computing, Data Mining, Machine Learning, Engineering Principles, Image Processing*

B.S. Astronomy **MAY 2018**

The University of Arizona Tucson, AZ

Relevant Coursework*: Classical & Quantum Physics, Theoretical & Observational Astrophysics, Orbital Dynamics, Computational Programming (including Galactic Data Modeling & Analysis), Mathematics*

Skills

Computer: Python, SQL, HTML, R, Git/Github, LaTEX, TensorFlow, Scikit-learn, PyTorch, Apache Spark, Jupyter, Numpy, Pandas, Matplotlib, Plotly

Data Science, Machine & Deep Learning, Data Visualization & Analysis, Statistics, Observational & Computational Astrophysics, Telescope Operations, Image Processing, AI/ML applications for Earth and Planetary Sciences

Quantitative Research, Developing Scientific Proposals and Publications, Developing Technical Reports and Presentations, STEM Outreach and Leadership, Science Communication, Public Speaking, Mentoring, Computer Hardware Repairs and Troubleshooting, Event Planning, Fundraising

Problem Solving, Critical Thinking, Decision Making, Detail-Oriented, Excellent Written and Verbal Communication, Virtual & In-Person Collaboration, Customer Service, Rapport-Building, Active Listening, Empathy, Conflict Resolution

Extracurriculars: Web Design & Development, Digital Art, Independent Learning

Publications

1. Calahan, J. K., Shirley, Y. L., Svoboda, B. E., Ivanov, E. A., Schmid, J. R., Pulley, A., Lautenbach, J., Zawadzki, N., Bullivant, C., Cook, C. W., Gray, L., Henrici, A., Pascale, M., Bosse, C., Chance, Q., Choi, S., Dunn, M., Jaime-Frias, R., Kearsley, I., … Robinson, D. R. (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/gkvm47
2. 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 [Preprint]. *ESS Open Archive*. https://doi.org/10.1002/essoar.10511054.2
3. Dunn, M. M., Duncan, E., Trent, D., Santerre, J., Mills, A., Larsen, A., Neidel, I. & Nixon, C. A. (2023). *Detection and Segmentation of Ice Blocks in Europa's Chaos Regions Using Deep Learning*. [Unpublished manuscript]. NASA Goddard Spaceflight Center.

Posters & Presentations

4. Ryleigh Fitzpatrick, M., Pearson, K., Griffith, C. A., Dunn, M., Montiel, N. J., Zellem, R. T., Calahan, J., Chance, Q., Henrici, A., Sanchez, D., & AzGOE. (2016). *A Study of the Effects of Underlying Assumptions in the Reduction of Multi-Object Photometry of Transiting Exoplanets*. *227*, 138.07. https://ui.adsabs.harvard.edu/abs/2016AAS...22713807R
5. Dunn, M. M., Lesser, D., O'Dougherty, S., Swift, B., Pat, T., Cortez, G., Smith, S., Goldsmith, P., & Walker, C. K. (2017). *TeraHertz Space Telescope (TST). 229*, 238.30. https://ui.adsabs.harvard.edu/abs/2017AAS...22923830D
6. Dunn, M., Chazaro Cortes, J., Nguyen, D. M. (2021, December 8). *Optimizing Data Formats for Earth Information System Fire Portal*. [Poster presentation]. NASA Goddard Space Flight Center.
7. 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.
8. Dunn, M. (2022, August 4). *Visualizing Model Optimization for Orbital Debris Characterization*. [PowerPoint slides]. Data Science Summer Institute, Lawrence Livermore National Laboratory.
9. Dunn, M. (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.
10. Dunn, M. , Na, D., Trent, D. (2022, November 15-17). *The Machine Learning Showroom*. [Conference session]. 2022 NASA Data Science Summit, NASA Langley Research Center, Hampton, VA, USA.
11. Dunn, M., Ćiprijanović, A., Nord, B., & Mobasher, B. (2023). Galaxy Morphology Classification Using Bayesian Neural Networks for LSST. 55, 105.13. https://ui.adsabs.harvard.edu/abs/2023AAS...24110513D
12. Dunn, M. (2023, February 23). *A Long Time Ago In a Galaxy Far, Far Away: Using Machine Learning to Classify Galaxy Morphologies*. [Presentation]. 2023 University of California, Riverside Grad Slam Semi-Finals Competition, Riverside, CA, USA. https://gsrc.ucr.edu/grad-slam-2023
13. Dunn, M. (2023, March 9). *A Long Time Ago In a Galaxy Far, Far Away: Using Machine Learning to Classify Galaxies*. [Presentation]. 2023 University of California, Riverside Grad Slam Finals Competition, Riverside, CA, USA. https://gsrc.ucr.edu/grad-slam-2023
14. Dunn, M. M., Duncan, E., Mills, A. C., Santerre, J. , Larsen, A. , Trent, D. M., Neidel, I., Yahn, Z., Nixon, C. A. (2023, May 2-3). *Detection and Segmentation of Ice Blocks in Europa's Chaos Regions Using Deep Learning*. [Conference session]. 2023 Outer Planets Assessment Group Meeting, John Hopkins University, Laurel, MD, USA.

15. Dunn, M. M. (2023). *Galaxy Morphology Classification Using Bayesian Neural Networks for the Legacy Survey of Space and Time (LSST).* [Master's thesis, University of California, Riverside].

Research Experience

M.S. Thesis — Deep Skies Lab, University of California, Riverside **SEP 2021 - PRESENT**

- Investigating the use of Bayesian Neural Networks and transfer learning techniques to classify galaxy morphologies in simulated imaging datasets representing different observing years in preparation for the upcoming large-scale Legacy Survey of Space & Time (LSST). Exploring effects of observational realism (i.e. observational noise) on model performance. **[11, 12, 13, 15]**

CRESST II Research Assistant — NASA Goddard Space Flight Center **JAN 2023 - PRESENT**

- Investigating using deep learning approaches (regional convolutional neural networks) and transfer learning techniques to detect ice blocks in the "chaos terrain" regions of Europa. **[3, 14]**

Data Science Graduate Intern — NASA Langley Research Center **AUG - DEC 2022**

- Developed simplified, cloud-based, "read-to-try" machine learning models, visualization tools, and online content for NASA teams to evaluate potential of using these approaches for their work, as part of the "Machine Learning Showroom" project. **[10]**

Computing Scholar — Data Science Summer Institute, Lawrence Livermore National Laboratory **MAY - AUG 2022**

- Developed tool for visualizing model optimization for the scalable Gaussian Process method MuyGPs, used to predictively fill in gaps of observations of orbital debris. **[8]**
- Investigated various machine learning approaches using chemical molecular descriptors and 3D atomic representations to rapidly screen drug-like compounds targeting SARS-CoV-2, in an effort to identify which may best treat the virus. **[9]**

Graduate Intern — NASA Goddard Space Flight Center **AUG 2021 - MAY 2022**

- Investigated methods for optimally migrating and storing NASA Earth Science data & models to cloud-optimized, analysis-ready formats. **[2, 6]**
- Developed improved interactive visualization/analysis dashboards for NASA fire data, including for near-real-time fire emissions forecasting, and vegetation data, such as the Surface Biology and Geology hyper-spectral imaging SHIFT campaign. **[7]**

Undergraduate Research Assistant — University of Arizona **JUNE 2016 - SEP 2017**

- Wrote proposals for a high resolution, spherical, space-based, inflatable observatory Terahertz Space Telescope. Presented proposal at the 2017 American Astronomical Society conference in Grapevine, TX. **[5]**
- Built and tested radio telescope antenna prototypes in a welding shop, presented preliminary results for the Office of Naval Research (ONR), resulting in full project funding.
- Wrote significant proposal components, procured institutional letters of intent and instrument estimates, managed large budgets, supported weekly science & engineering meetings for two NASA missions: the Europa Ice and Ocean Structure Seismometer (SIIOS), and the balloon-borne observatory GUSTO. Additionally organized 2017 NASA site visit for GUSTO, marking project transition into the next mission phase, and $40 million in funding.
- Analyzed sub-millimeter astronomy data of molecular transitions, created visual maps of gas flows within a giant molecular clouds using Python, and confirmed previous hypotheses about suspected ongoing star formation.

Undergraduate Researcher — University of Arizona Astronomy Club **JAN 2015 - MAY 2018**

- Observed 101 dense, dark molecular clouds with the 12-Meter Arizona Radio Observatory Telescope on Kitt Peak, AZ, & determined which were actively collecting enough material to produce future stars using radiative transfer models. Published research in 2018. **[1]**

Undergraduate Researcher — University of Arizona **AUG 2014 - DEC 2016**

- Observed transiting exoplanets and operated the Kuiper 61" Telescope on Mt. Bigelow, AZ, analyzed observational data in multiple wavelengths to determine the composition of their atmospheres. Determined which data reduction techniques better reveal atmospheric characteristics, such as using brighter nearby reference stars. Co-presented research at the 2016 American Astronomical Society conference in Kissimmee, FL. **[4]**

Past & Present Professional Memberships

Academic Data Science Alliance, American Astronomical Society, Association for Computing Machinery (ACM), ACM SIGHPC, Deep Skies Lab, oSTEM, UCR Women in Computing, Society of Women Engineers, Graduate Women in Science, Girls in Tech Nashville,

Rubin Observatory LSST Science Collaborations (Informatics & Statistics, Galaxies, Solar System)

Honors, Awards & Distinctions

2023 UCR Bourns College of Engineering Commencement Graduate Student Marshal - University of California, Riverside

2023 Wanda Munn Scholarship (offered), 2023 WE Local Collegiate Competition Finalist, WE22 Conference Grant (2022)- Society of Women Engineers

2023 UCR Graduate Division Grad Slam Finalist - University of California, Riverside

Funds for Astronomical Meetings: Outreach to Underrepresented Scientists (FAMOUS) Travel Grant (2023) - American Astronomical Society

Grace Hopper Celebration Student Scholar (2022) - AnitaB.org

Uncertainty Quantification for Machine Learning Integrated Physics Modeling Travel Award (2022) - National Science Foundation/Sandia Laboratories

Honors College Alumni Legacy Grant (2016) - The University of Arizona Honors College

Arizona Excellence Scholarship (2014), Angelos C. Langadas Astronomy Department Scholarship (2017) - The University of Arizona

Additional Work Experience

Data Science Engineer —Strategic Data Solutions Team, Apple Inc. **JAN 2021 - JUNE 2021 (6-month Program)**

- Developed data pipeline using Python that utilizes web APIs to create & maintain records of "high risk/priority" customers to mitigate unwarranted personal information searches by employees.
- Designed system to send weekly reports with statistics (i.e. recent additions, page visits).

Data Engineer — Data Analytics Server Engineering Team, Apple Inc. **JAN 2020 - JULY 2020 (7-month Program)**

- Developed and deployed code that utilizes Apache Spark, Python, and SQL to create interactive historical table of active iOS devices transmitting diagnostics/usage analytics data with statistics (i.e. current OS version).
- Designed systems to inform other teams about device populations, used for business-critical reports, and allows for less-expensive lookups.

Technical Expert (Previously Technical Specialist) — Genius Bar, Apple Inc. **OCT 2018 - AUG 2021**

- Resolved customer technical issues through software troubleshooting & hardware repairs, and provided exceptional customer service, including repairing customer relationships by de-escalating & approaching situations with empathy & practical, ethical problem-solving.
- Demonstrated ability to be flexible and knowledgeable in a high-pressure, fast-paced environment as products & services evolve.
- Supported additional departments, including in-house technology diagnostics & troubleshooting, visual merchandising, leading creative sessions (i.e. coding, visual art), & inventory operations.

Chief Telescope Operator — University of Arizona Steward Observatory **AUG 2014 - MAY 2018**

- Oversaw weekly operations of multiple on-campus telescopes, led nightly public astronomy talks, managed a team of student telescope operators, and organized local private & educational STEM outreach events.
- Assisted professors with teaching tasks, such as grading, and class/lab preparation for general education astronomy courses.

Instructional Specialist — Astronomy Camp, University of Arizona Steward Observatory **JUNE 2015, 2018, 2019**

- Oversaw operations, administered medical care, worked extended/irregular hours, and managed large groups of students for 8 consecutive days/nights at remote observatories.
- Facilitated all-night astronomy observing sessions with professional telescopes, teaching students about telescopes, electronic instrumentation, & astronomy image processing software.
- Developed educational STEM content for students, including astronomy, physics, engineering, environmental science, and computing using inquiry-based learning techniques.

Volunteer & Leadership Experience

Astronomer — Vanderbilt University Dyer Observatory **JUNE 2009 - PRESENT**

- Facilitated monthly telescope viewings, and led public evening lectures and tours, teaching audiences about STEM concepts, operating professional telescopes, and performing science outreach experiments as a volunteer astronomer & space camp counselor, beginning at age 13.

Outreach Coordinator (2016 - 2017), President (2017 - 2018) — University of Arizona Astronomy Club **AUG 2014 - MAY 2018**

- Presented engaging content weekly for undergraduate students passionate about space, and organized club meetings, fundraisers, and professional research opportunities.
- Partnered with local schools to provide free telescope viewings and STEM activities at more than 300 events.
- Established the free Astronomy Tutoring of Majors & Minors (ATOMM) tutoring service for upper-division astronomy and physics classes.

TIMESTEP Student Leader — University of Arizona **AUG 2015 - MAY 2018**

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

Invited Talks & Panels

"Navigating the First Two Years of Physics/Astronomy Programs." Panel discussion with Khalid Omer and Kevin Perez, presented for University of Arizona's Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP), Tucson, AZ, September 6, 2017.

"Gap Year Planning & Industry Careers." Panel presentation with Tyler Baines and Junellie Gonzalez-Quiles, presented virtually for University of Arizona's Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP), February 5, 2020.

"Gap Year Planning." Panel presentation with Kaylah McGowan, Jose Perez, and Alex Stoken, presented virtually for University of Arizona's Tucson Initiative for Minoritized Student Engagement in Science and TEchnology Program (TIMESTEP), February 16, 2022.

"Data Reconstruction: AI/ML's Place in NASA's Future." Panel presentation with Grace Goff, Adriana Holst, and Jessica Robinson, presented virtually for NASA, November 29, 2022.

Press & Contributions

Peters-Lidard, C., Shiklomanov, A., Kumar, S., & Felikson, D. (2021, November 12). *Analysis-ready Fire, Freshwater, and Sea Level Change Products*. NASA@SC21. https://www.nas.nasa.gov/SC21/research/project41.html

Lewis, B. (2021, December 3). *Bringing Together Art & the Cosmos*. Astrobites.

Million STEM. (2020, May 18). *Marina Madeline Dunn*. Million STEM.

Dunn, M., Fulmer, L., & Gagliano, A. (2018, May 6). *How to Land a Post-Baccalaureate Research Experience*.