

# David R. Rice

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Planet Interiors, Dynamics, and Formation; Computational Techniques; Interdisciplinary Collaborations

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| CONTACT INFORMATION | Department of Physics and Astronomy<br>University of Nevada, Las Vegas<br>Las Vegas, NV 89154, USA | Email: See Website<br>Website: <a href="https://davidrrice.github.io">davidrrice.github.io</a><br>ORCID: <a href="https://orcid.org/0000-0001-6009-8685">0000-0001-6009-8685</a> |
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| EDUCATION | <b>Ph.D. Astronomy</b> , University of Nevada, Las Vegas<br><b>M.S. Astronomy</b> , University of Nevada, Las Vegas<br>Dissertation Advisor: Prof. Jason H. Steffen<br>Dissertation Title: <i>Inferences of a planet's interior structure</i><br>M.S. Thesis Title: <i>The timing of dynamical interactions between planets</i> | <b>May 2023</b><br><b>Dec. 2019</b> |
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|  | <b>B.A. Integrated Science with Honors, Physics &amp; Astronomy, and Earth &amp; Planetary Sciences</b> , Northwestern University, Evanston, IL<br>Senior Thesis Advisor: Prof. Fred Rasio | <b>Jun. 2016</b> |
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| RESEARCH EXPERIENCE | <b>Star &amp; Planet Formation Group</b><br>Nevada Center for Astrophysics, Las Vegas, NV<br><i>Characterizing Planet Interiors</i><br>Developed MAGRATHEA, an open-source interior structure model featuring enhanced flexibility and extensibility. Collaborated with high-pressure physicists and geologists to implement the newest equation of state measurements. Characterized the interiors of the planets in the K2-138 and Trappist-1 systems. | <b>Aug. 2017–Present</b> |
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|  | <i>Timescales of Instabilities in Planetary Systems</i><br>Simulated tens of thousands of planetary systems on Cherry-Creek, UNLV's computer cluster. Determined an inclination criteria for the long-term survival of tightly-packed systems. | <b>Aug. 2017–Present</b> |
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|  | <b>Center for Interdisciplinary Exploration &amp; Research in Astrophysics</b><br>Northwestern University, Evanston, IL<br><i>Survival of Closely Packed Planetary Systems</i> | <b>Jan. 2013–Aug. 2016</b> |
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|  | <b>Laboratory for Atmospheric and Space Physics NSF REU</b><br>Southwest Research Institute, Boulder, CO, advised by Dr. Craig DeForest<br><i>Turbulence in the Solar Wind</i> | <b>Jun. 2014–Aug. 2014</b> |
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| AWARDS & CERTIFICATIONS | <b>President's Foundation Graduate Research Fellowship, UNLV</b><br><b>Graduate Mentorship Certificate, UNLV</b><br><b>1st Place, GPSA Research Forum Podium Session, UNLV</b><br><b>Donna Weistrop &amp; David B. Shaffer Scholarship, UNLV</b> | <b>2022</b><br><b>2022</b><br><b>2021, 2022</b><br><b>2018, 2019</b> |
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| AWARDS &<br>CERTIFICATIONS<br>(CONTINUED) | <b>Nevada Space Grant Graduate Fellowship, NASA</b> | <b>2018</b>                              |
|   | <b>Dean's List, Northwestern University</b>         | <b>Fall 2013, Fall 2014, Spring 2016</b> |
|   | <b>Illinois Undergraduate Space Grant, NASA</b>     | <b>2015</b>                              |

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| TEACHING<br>EXPERIENCE | <b>Lab Instructor</b> , University of Nevada, Las Vegas |                            |
|                        | Phys. 180L, Mechanics Lab                               | <b>9 Sections, 5 Terms</b> |
|                        | Phys. 181L, Electromagnetism Lab                        | <b>2 Sections, 1 Term</b>  |
|                        | Phys. 151L, General Physics I Lab                       | <b>6 Sections, 3 Terms</b> |
|                        | Phys. 152L, General Physics II Lab                      | <b>5 Sections, 4 Terms</b> |

**SAGA Education Math Teacher**, Chicago, IL **Aug. 2016–Jun. 2017**

Delivered a daily, individualized, small-group class in algebra and geometry at Phillips Academy High School with 96% low-income students.

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| MENTORING | <b>Undergraduate students</b> |                            |
|           | Tristan Benally               | <b>Fall 2021–Present</b>   |
|           | Rosalie Chaleunsouck          | <b>Fall 2021–Fall 2022</b> |

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| PROFESSIONAL<br>ACTIVITIES,<br>OUTREACH, AND<br>SERVICE | <b>Workshop/Seminar organizer</b>                                     |                              |
|   | Let's Build a Planet: Improving Interior Models,                      | <b>Jul. 2022</b>             |
|   | <b>Rocky Worlds II Conference</b> , 50 break-out session participants |                              |
|   | Journal Club and Astro Coffee, UNLV                                   | <b>Fall 2018–Spring 2019</b> |

### Journal referee

The Astrophysical Journal, Monthly Notices of the Royal Astronomical Society, and Publications of the Astronomical Society of Japan.

### Outreach

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| Astronomy on Tap, Las Vegas   | <b>Jun. 2018–Present</b> |
| Founder, Lead Organizer, and Emcee                                  |                          |
| Led quarterly events with over 50 attendees per event               |                          |
| Skype a Scientist   |                          |
| Invited video Q&A, 5th grade project                                | <b>Feb. 2022</b>         |
| Invited video lecture, 5th grade class: "Are Exoplanets Habitable?" | <b>Feb. 2021</b>         |
| Invited video lecture, high school astronomy club                   | <b>Feb. 2021</b>         |
| Invited video lecture, 11th grade physics class                     | <b>Apr. 2020</b>         |
| STEM Nova Award Scouts Day Camp                                     | <b>Jan. 2022</b>         |
| Science Advisor and Station Organizer                               |                          |
| Dallas Center-Grimes High School                                    | <b>Jan. 2022</b>         |
| Invited lecture, AP Physics class                                   |                          |

**Outreach (Continued)**

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| Camp Hippocampus Employee Astronomy Night<br>Invited lecture: “Our Cosmic Address”  | <b>Sep. 2021</b> |
| Las Vegas Astronomical Society monthly meeting<br>Invited lecture: “Exoplanets”   | <b>Jun. 2020</b> |
| The CSN Planetarium Astronomy Q&A livestream<br>Invited lecture: “The Pluto Controversy”, [ <a href="https://youtu.be/EnzSoXZJtIs">https://youtu.be/EnzSoXZJtIs</a> ] | <b>Spr. 2020</b> |

**Volunteer Service**

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| Volunteer Observer with Project RECON                     | <b>Oct. 2021</b> |
| Judge for Southern NV Regional Science & Engineering Fair | <b>Mar. 2022</b> |

**COMPUTER  
SKILLS****Expert/Proficient**

Programming: Python, C++, shell script, Matplotlib, and LaTeX  
 Software: Mercury6 and REBOUND (n-body integrators)  
 Supercomputing with Cherry Creek, UNLV and QUEST, Northwestern

**Familiarity**

MESA (stellar evolution), IDL, Perl, Perl Data Language, HTML, and ArcGIS

**PUBLICATIONS**

6. **Rice, D. R.**, Steffen, J. H., (2022) *Stable lifetime of compact, evenly-spaced planetary systems with non-equal masses*, Submitted to MNRAS, [[arXiv:2206.11374](https://arxiv.org/abs/2206.11374)].
5. Huang, C. H., **Rice, D. R.**, Steffen, J. H., (2022) *MAGRATHEA: An open-source spherical symmetric planet interior structure code*, **MNRAS**, **513**, 5256 [[arXiv:2201.03094](https://arxiv.org/abs/2201.03094)].
4. MacDonald, M. G., Feil, L., Quinn T., **Rice, D. R.**, (2022) *Confirming the 3:2 Resonant Chain of K2-138*, **AJ**, **163**, 162 [[arXiv:2201.12687](https://arxiv.org/abs/2201.12687)].
3. Huang, C., **Rice, D. R.**, Grande, Z. M., Smith, D., Smith, J. S., Boisvert, J. H., Tschauner, O., Salamat, A., Steffen, J. H., (2021) *Implications of an improved water equation of state for water-rich planets*, **MNRAS**, **503**, 2825 [[arXiv:2103.01410](https://arxiv.org/abs/2103.01410)].
2. **Rice, D. R.**, Rasio, F. A., Steffen, J. H., (2018) *Survival of non-coplanar, closely packed planetary systems after a close encounter*, **MNRAS**, **481**, 2205 [[arXiv:1807.07668](https://arxiv.org/abs/1807.07668)].
1. DeForest, C. E., Matthaeus, W. H., Howard, T. A., **Rice, D. R.**, (2015) *Turbulence in the solar wind measured with comet tail test particles*, **ApJ**, **812**, 108

**INVITED TALKS**

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| 4. The Ohio State University, Exoplanet Talk Series                  | Oct. 2022 |
| 3. The University of Chicago, Exoplanet Journal Club                 | Oct. 2022 |
| 2. Northwestern University, Astro Theory Group                       | Sep. 2022 |
| 1. PennState, The Center for Exoplanets and Habitable Worlds Seminar | Sep. 2022 |

CONTRIBUTED  
TALKS

6. Exoplanets IV, Las Vegas, NV May 2022  
“Investigating systematic uncertainties in terrestrial interior models with MAGRATHEA”, [<https://my.aas.org/services/AASTCS9>]
5. Graduate & Professional Student Research Forum, UNLV Apr. 2022  
“Systematic uncertainties in terrestrial interior models with MAGRATHEA”, [<https://youtu.be/6SNhho28NQ0>]
4. Graduate & Professional Student Research Forum, UNLV Apr. 2021  
“Characterizing the composition of small exoplanets”
3. Habitable Worlds 2 Conference, Online Feb. 2021  
“MAGRATHEA: Terrestrial planet interior solver and the degeneracy of interiors”, [<https://youtu.be/1AXe-EvkPcc>]
2. Chicago Exoplanet Meeting, The University of Chicago, IL Jun. 2015  
“Dynamical instability in exoplanetary systems”
1. LASP REU, Boulder, CO Jul. 2014  
“Analysis of comet tails for turbulence in the solar wind”, [<https://my.aas.org/services/AASTCS9>]

CONTRIBUTED  
POSTERS

5. Rocky Worlds II, Oxford, UK Jul. 2022  
“Investigating systematic uncertainties in terrestrial interior models with MAGRATHEA”
4. Exoplanets III, Online Jul. 2020  
“MAGRATHEA: Terrestrial planet interior solver and the degeneracy of interiors”, [<https://www.physics.unlv.edu/~drice986/Exo3Poster/riceexoposter.html9>]
3. Sagan Exoplanet Summer Workshop, Pasadena, CA Jul. 2019  
“Differentiated collisions and their effect on terrestrial planet composition”, [[https://nexsci.caltech.edu/workshop/2019/posters/Rice\\_Sagan\\_Poster.pdf](https://nexsci.caltech.edu/workshop/2019/posters/Rice_Sagan_Poster.pdf)]
2. Kepler & K2 Science Convention V, Glendale, CA Mar. 2019  
“The effect of differentiated collisions on the interiors of terrestrial planets”
1. 227th American Astronomical Society Meeting, Kissimmee, FL Jan. 2016  
“Understanding dynamical instability in 4-planet systems with equal orbital spacing”

## REFERENCES

**Jason H. Steffen**, Associate Professor of Physics, University of Nevada, Las Vegas

**Mariah G. MacDonald**, Assistant Professor of Physics, The College of New Jersey

**Fred A. Rasio**, Professor of Physics, Northwestern University