David R. Rice

Planet Interiors and Dynamics; Computational Techniques; Interdisciplinary Collaborations

Contact Information

Department of Physics and Astronomy
University of Nevada, Las Vegas
Las Vegas, NV 89154, USA

Email: See Website
Website: davidrrice.github.io
ORCiD: 0000-0001-6009-8685

Education

Ph.D. Astronomy, University of Nevada, Las Vegas **May 2023**
M.S. Astronomy, University of Nevada, Las Vegas **Dec. 2019**
Dissertation Advisor: Prof. Jason H. Steffen
Dissertation Title: *Inferences of a planet's interior structure*
M.S. Thesis Title: *The timing of dynamical interactions between planets*

B.A. Integrated Science with Honors, Physics & Astronomy, and Earth & Planetary Sciences, Northwestern University, Evanston, IL **Jun. 2016**
Senior Thesis Advisor: Prof. Fred Rasio

Research Experience

Star & Planet Formation Group
Nevada Center for Astrophysics, Las Vegas, NV

Characterizing Planet Interiors **Aug. 2017–Present**
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..

Timescales of Instabilities in Planetary Systems **Aug. 2017–Present**
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.

Center for Interdisciplinary Exploration & Research in Astrophysics
Northwestern University, Evanston, IL

Survival of Closely Packed Planetary Systems **Jan. 2013–Aug. 2016**

Laboratory for Atmospheric and Space Physics NSF REU
Southwest Research Institute, Boulder, CO, advised by Dr. Craig DeForest

Turbulence in the Solar Wind **Jun. 2014–Aug. 2014**

Awards & Certifications

President's Foundation Graduate Research Fellowship, UNLV **2022**
Graduate Mentorship Certificate, UNLV **2022**
1st Place, GPSA Research Forum Podium Session, UNLV **2021, 2022**
Community Engagement Student Service Honorable Mention, UNLV **2021**
Donna Weistrop & David B. Shaffer Scholarship, UNLV **2018, 2019**

Awards & Certifications (Continued)

Nevada Space Grant Graduate Fellowship, NASA **2018**
Dean's List, Northwestern University **Fall 2013, Fall 2014, Spring 2016**
Illinois Undergraduate Space Grant, NASA **2015**

Teaching Experience

Lab Instructor, University of Nevada, Las Vegas
Phys. 180L, Mechanics Lab **9 Sections, 5 Terms**
Phys. 181L, Electromagnetism Lab **2 Sections, 1 Term**
Phys. 151L, General Physics I Lab **6 Sections, 3 Terms**
Phys. 152L, General Physics II Lab **5 Sections, 4 Terms**

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.

Mentoring

Undergraduate students
Tristan Benally **Fall 2021–Present**
Rosalie Chaleunsouck **Fall 2021–Fall 2022**

Professional Activities, Outreach, and Service

Workshop/Seminar organizer
Let's Build a Planet: Improving Interior Models, **Jul. 2022**
Rocky Worlds II Conference, 50 break-out session participants
Journal Club and Astro Coffee, UNLV **Fall 2018–Spring 2019**

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

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

Outreach (Continued)

Las Vegas Astronomical Society monthly meeting **Jun. 2020**
Invited lecture: "Exoplanets"

The CSN Planetarium Astronomy Q&A livestream **Apr. 2020**
Invited lecture: "The Pluto Controversy", [https://youtu.be/EnzSoXZJtIs]

Volunteer Service

Judge for AAS Chambliss Student Achievement Awards **Jan. 2023**

Judge for Southern NV Regional Science & Engineering Fair **Mar. 2022**

Volunteer Observer with Project RECON **Oct. 2021**

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

7. Childs, A. C., Yang, C., Shakespeare, C., **Rice, D.R.**, Steffen, J. H., (2023) *Composition constraints of the TRAPPIST-1 planets from their formation*, Submitted to MNRAS.
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].
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].
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].
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].
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].
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

4. The Ohio State Univeristy, 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

8. NASA's Exoplanet Modeling and Analysis Center Workshop, Virtual **Feb. 2023**
   "Solving and visualizing planet interiors with MAGRATHEA"
7. 241st American Astronomical Society Meeting, Seattle, WA **Jan. 2023**
   "Interior models of small planets"
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",

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/d̃rice986/Exo3Poster/riceexoposter.html9]
3. Sagan Exoplanet Summer Workshop, Pasadena, CA **Jul. 2019**
   "Differentiated collisions and their effect on terrestrial planet composition"
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