Assistant Professor Meridith Joyce, PhD

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Summary Statistics

Current: Assistant Professor (TT), U Wyoming (R1)
Funding (PI): $629,000 USD (total US + Euro)
Publications: 70+ (21 lead; 6 student-led)
Invited talks: 60+; plenary at TASC
Teaching: PHYS 4840; median eval 5/5 "excellent"
Fields: Computational Stellar Astrophysics, ML/AI/DS
Funding (Co-I): $1.3M USD (total US + Euro)
h-index: 23 (Google Scholar, Nov 25, 2025)
Group: 1 postdoc; 3 PhD; 1 MSc, 1 UG
Leadership: Program Director, MESA SS 2023 & 2026

Research Interests & Areas of Expertise

Theoretical and computational astrophysics: stellar structure and evolution, Galactic archaeology, Galactic formation, stellar demographics, stellar age determinations, stellar interiors, stellar pulsations and asteroseismology, convection and mixing, stars across the mass and evolutionary spectra (late-stage, high-mass, young, etc.), numerical methods, astronomy software development.

Applied Math, Computing, DS/ML/AI: Forward and inverse modeling of PDE-governed systems, predictive model training, emulators, physics-informed surrogate models, high-dimensional manifolds, high-performance computing, workflow development/automation, job distribution optimization, grid calculations, training set construction and bias mitigation, statistics and uncertainty analysis, MCMC & covariance-agnostic modeling techniques, genetic algorithms, PCA

Stellar evolution tools: MESA (developers team & leadership), MIST (dev team), DSEP, GYRE, YREC, Monash

Observational astronomy: variable and oscillating stars, low-metallicity stars, globular clusters; Gaia, TESS

Research Positions and Fellowships

Assistant Professor, tenure-track — University of Wyoming, August 2024–present
Jointly appointed in the School of Computing (60%), Physics and Astronomy (40%), and Math and Statistics (adjunct)

Scialog Early Career Faculty Prize Fellow (50 Awardees), *Early Science with LSST*, 2024–present

Marie Skłodowska-Curie Widening Fellowship — CSFK Konkoly Observatory, September 2022–August 2024

Lasker Data Science Fellowship — Space Telescope Science Institute, NASA, June 2021–September 2022

Modules for Experiments in Stellar Astrophysics (MESA) developers team, September 2019–present

RSAA Postdoctoral Fellow — Australian National University, September 2018–June 2021

Visiting Astronomer — University of Cape Town, June 2017–January 2019

Postgraduate Research Assistant (pre-doc) — South African Astronomical Observatory, June–November 2017

Research Assistant — Dartmouth College, September 2013–July 2018

Research Assistant — Massachusetts Institute of Technology, June–August 2015

Education

Ph.D. Physics and Astronomy — Dartmouth College, 2018 — Prof. Brian Chaboyer, adviser
On the Scope and Fidelity of 1-D Stellar Evolution Models, PhD Thesis

B.Sc. Mathematics — Bucknell University, 2009–2013

B.Sc. Physics — Bucknell University, 2009–2013
full academic scholarship via the university's Presidential Fellowship

Grants, Proposals & Funding Secured

Principal Investigator

* **$299,999 (USD)** — **NSF EPSCoR Research Infrastructure Improvement**: EPSCoR Research Fellows
EPSCoR Research Fellows: NSF: Unraveling Cosmological Tensions by Modeling the Oldest Stars with Improved Treatments of Convection in Stellar Interiors, 2025

* **$12,000 (USD)** — **Simons Foundation**
Supplemental Support for the 2026 MESA Summer School in Wyoming, 2025

* **$20,000 (USD)** — **Wyoming NASA Space Grant Faculty Research Initiation**, 2025–2026 round
Unraveling Cosmological Tensions by Modeling the Oldest Stars with Improved Treatments of Convection in Stellar Interiors

* **HST Director's Discretionary Time**, Cycle 32, 2024 ($40,000 (USD) equivalent but funds were exhausted)
Far-UV Detection of the Low-mass Companion Responsible for Betelgeuse's Long Secondary Period. 2024

* **Chandra X-Ray Observatory Director's Discretionary Time**, Cycle 26, 2024 (no funding)
X-ray detection of the low-mass companion responsible for Betelgeuse's long secondary period, 2024

* **$70,000 (USD)** — **TESS GI Cycle 7**
A Five-fold Increase in "Holy Grail" Calibrators for Stellar Models: Doubly-Oscillating Binaries Pre-Screened with Gaia, 2024

* **€151,850.88** — **Marie Skłodowska-Curie Actions (MSCA) Widening Fellowship**, European Commission's Horizons 2020 program, 2021–2022 round
MATISSE: Measuring Ages Through Isochrones, Seismology, and Stellar Evolution
with a proposal score of 91/100 in the physics category; over 2 years

* **$48,000 (USD)** — **Lasker Data Science Fellowship**, Space Telescope Science Institute, February 2021; discretionary research spending; over 3 years

* **Nordic Institute for Theoretical Physics (Nordita) Prize Fellowship**, 2020–2021 round, declined

* **$8,000.00 (USD)** — International Research Network for Nuclear Astrophysics (IReNA) travel grant to support the `MESA`@Konkoly 2023 Summer School

* **$4,000.00 (AUD)** — RSAA Distinguished Visitors Program, *Seismic Evolution of Variable Stars*, March 2020; to fund the travel, housing, and research expenses of Dr László Molnár while in Australia for collaboration with me on proposed project. Highly competitive program awarded to only two researchers per year

* **$1,000.00 (USD)** — Research Grant from the Neukom Institute for Computational Science, December 2017; Awarded to only three graduate students per year across all computational disciplines

Under Review:

- NSF AAG proposal *Collaborative Research: Age Against the Machine: Machine Learning-enabled Age Determinations for Star Clusters with Heterogeneous Constraints* **($358,300 for lead PI Joyce)**

- NSF AAG proposal *Collaborative Research: A Machine Learning enabled view of the Metallicity, Kinematics, and Structure of the Galactic bulge/bar* **($451,365 for Co-PI Joyce)**

- Scialog Fellows Program *Early Science with LSST* proposal *Constraining the Occurrence of Low-mass Population III Stars with Rubin's LSST* **($60,000)**

- Scialog Fellows Program *Early Science with LSST* proposal *Jumping on the Band-MWAGN: LSST and the Influence of the Milky Way AGN Phase on the Evolution of the Galaxy* **($60,000)**

- NSF CAREER proposal *CAREER: Inside Every Star: Unraveling the Formation of the Galaxy with Population-Scale Stellar Interior Constraints from Mode-Identified Seismology* **($838,008.00)**

Co-Investigator and/or substantial knowledge contribution

* **$405,459 (USD) — NASA Astrophysics Theory Program (ATP) Proposal**, Co-I (PI: Jamie Tayar), *Modeling Red Giants: A Fundamental Diagnostic for Ages Across the Universe*; over 3 years

* **299 800 000 HUF (approx. $946,000 USD)** — *Asteroseismic Laboratories (SeismoLab)* Élvonal Research Excellence Program, Hungarian Research, Development and Innovation Office, Co-I (PI László Molnár); over 5 years

Competitively ranked but unfunded (AY 2024–2025):

- Co-I (PI Anthony Gonzalez/Jamie Tayar, U Florida), NASA Pioneers, submitted April 2025 ($20,000,000 total, **$300,000 subaward** to University of Wyoming)

List of Publications

Over 70 total papers (some pending papers are not listed), nearly all in the highest-impact astronomy journals. Among these are **22 first author or equivalent** (e.g. joint first author; assuming leadership of projects after original first author departed) and an additional six led by students under my direct supervision.
Current h-index: 23

First Authorships & Equivalent Contributions (22)

1. N. Miller, **M. Joyce**, C. I. Johnson et al., *Constraining the Two-Infall Formation of the Milky Way's Bulge using Galactic Chemical Evolution Models and Machine Learning*, 2025, submitted to ApJ

2. Y. Li, **M. Joyce**, *Beyond MESA Defaults: The Impact of Structural Resolution Uncertainty in p-mode Asteroseismology*, 2025, preprint DOI:10.48550/arXiv.2501.13207 (accepted, ApJ)

3. J. Tayar, **M. Joyce**, *Star-crossed Clusters: Asteroseismic Ages for Individual Stars Are in Tension with the Ages of Their Host Clusters*, 2025, ApJL DOI:10.3847/2041-8213/adcd6f

4. **M. Joyce**, J. A. Goldberg, L. Molnar, K. Breivik, A. Calamida, M. Drout, C. Johnson, M. Moe, A. O'Grady, *Far-UV detection of the low-mass companion responsible for Betelgeuse's long secondary period*, 2024, HST Proposal Cycle 31, ID #17881

5. J. A. Goldberg, **M. Joyce**, L. Molnár, *A Buddy for Betelgeuse: Binarity as the Origin of the Long Secondary Period in α Orionis*, 2024, ApJ DOI:10.3847/1538-4357/ad87f4

6. **M. Joyce**, L. Molnár, G. Cinquegrana, A. Karakas, J. Tayar, D. Tarczay-Nehéz, *Stellar Evolution in Real Time. II. R Hydrae and an Open-Source Grid of >3000 Seismic TP-AGB Models Computed with MESA*, 2024, ApJ DOI:10.3847/1538-4357/ad534a

7. T. Marchetti, **M. Joyce**, C. I. Johnson, et al., *The Blanco DECam Bulge Survey (BDBS). VIII. Chemo-kinematics in the southern Galactic bulge from 2.3 million red clump stars with Gaia DR3 proper motions*, 2024, A&A DOI:10.1051/0004-6361/202347570

8. **M. Joyce**, J. Tayar, *A Review of the Mixing Length Theory of Convection in 1D Stellar Modeling*, 2023, Galax DOI:10.3390/galaxies11030075

9. L. Molnár, **M. Joyce**, S.-C. Leung, *Comment on the Feasibility of Carbon Burning in Betelgeuse*, 2023, RNAAS DOI:10.3847/2515-5172/acdb7a

10. **M. Joyce**, C. I. Johnson, T. Marchetti, R. M. Rich, I. Simion, J. Bourke, *The Ages of Galactic Bulge Stars with Realistic Uncertainties*, 2023, ApJ DOI:10.3847/1538-4357/acb692

11. A. E. Fraser, **M. Joyce**, E. H. Anders, J. Tayar, M. Cantiello, *Characterizing Observed Extra Mixing Trends in Red Giants using the Reduced Density Ratio from Thermohaline Models*, 2022, ApJ DOI:10.3847/1538-4357/aca024

12. J. Tayar, **M. Joyce**, *Is Thermohaline Mixing the Full Story? Evidence for Separate Mixing Events near the Red Giant Branch Bump*, 2022, ApJL DOI:10.3847/2041-8213/ac85ab

13. **M. Joyce**, J. Tayar, D. Lecoanet, *Gender Disparity in Publishing Six Months after the KITP Workshop Probes of Transport in Stars*, 2022, PASP DOI:10.1088/1538-3873/ac83f1

14. S. J. Murphy, **M. Joyce**, T. R. Bedding, T. R. White, M. Kama, *A precise asteroseismic age and metallicity for HD 139614: a pre-main-sequence star with a protoplanetary disc in Upper Centaurus-Lupus*, 2021, MNRAS DOI:10.1093/mnras/stab144

15. **M. Joyce**, S.-C. Leung, L. Molnár, M. Ireland, C. Kobayashi, K. Nomoto, *Standing on the Shoulders of Giants: New Mass and Distance Estimates for Betelgeuse through Combined Evolutionary, Asteroseismic, and Hydrodynamic Simulations with MESA*, 2020, ApJ DOI:10.3847/1538-4357/abb8db

16. **M. Joyce**, *Asteroseismic Binaries as non-Solar Mixing Length Calibrators*, 2020, Conference Proceedings (Vienna 2019)

17. **M. Joyce**, L. Lairmore, D. J. Price, S. Mohamed, T. Reichardt, *Density Conversion between 1D and 3D Stellar Models with* ^{1D}*MESA2HYDRO*^{3D}, 2019, ApJ DOI:10.3847/1538-4357/ab3405

18. **Meridith Joyce** *Asteroseismic Binaries as non-Solar Mixing Length Calibrators*, Proceedings of the conference Stars and their Variability Observed from Space, Vienna, Austria, August 2019

19. L. Molnár, **M. Joyce**, L. L. Kiss, *Stellar Evolution in Real Time: Models Consistent with the Direct Observation of a Thermal Pulse in T Ursae Minoris*, 2019, ApJ DOI:10.3847/1538-4357/ab22a5

20. **M. Joyce**, B. Chaboyer, *Classically and Asteroseismically Constrained 1D Stellar Evolution Models of α Centauri A and B Using Empirical Mixing Length Calibrations*, 2018, ApJ DOI:10.3847/1538-4357/aad464

21. **M. Joyce**, B. Chaboyer, *Not All Stars Are the Sun: Empirical Calibration of the Mixing Length for Metal-poor Stars Using One-dimensional Stellar Evolution Models*, 2018, ApJ DOI:10.3847/1538-4357/aab200

22. **M. Joyce**, B. Chaboyer, *Investigating the Consistency of Stellar Evolution Models with Globular Cluster Observations via the Red Giant Branch Bump*, 2015, ApJ DOI:10.1088/0004-637X/814/2/142

Publications led by my students (6)

23. G. C. Cinquegrana, **M. Joyce**, A. I. Karakas, *Bridging the gap between intermediate and massive stars II: M_{mas} for the most metal-rich stars and implications for Fe CCSNe rates*, 2023, MNRAS DOI:10.1093/mnras/stad2461

24. G. C. Cinquegrana, **M. Joyce**, A. I. Karakas, *Bridging the Gap between Intermediate and Massive Stars. I. Validation of MESA against the State-of-the-Art Monash Stellar Evolution Program for a $2\,M_\odot$ AGB Star*, 2022, ApJ DOI:10.3847/1538-4357/ac87ae

25. G. C. Cinquegrana, **M. Joyce**, *Solar Calibration of the Convective Mixing Length for Use with the ÆSOPUS Opacities in MESA*, 2022, RNAAS DOI:10.3847/2515-5172/ac6611

26. J. Tang, **M. Joyce**, *Revised Best Estimates for the Age and Mass of the Methuselah Star HD 140283 Using MESA and Interferometry and Implications for 1D Convection*, 2021, RNAAS DOI:10.3847/2515-5172/ac01ca

27. Y. Zhou, T. Nordlander, L. Casagrande, et al., *The relationship between photometric and spectroscopic oscillation amplitudes from 3D stellar atmosphere simulations*, 2021, MNRAS DOI:10.1093/mnras/stab337

28. Y. Zhou, M. Asplund, R. Collet, **M. Joyce**, *Convective excitation and damping of solar-like oscillations*, 2020, MNRAS DOI:10.1093/mnras/staa1445

Substantial contributions not led by students (9)

29. A. Dotter, E. B. Bauer, M. Park, et al., *MESA Isochrones and Stellar Tracks (MIST) II: Models with α-enhanced chemical composition* (submitted, ApJ)

30. J. A. Goldberg, A. J. G. O'Grady, **M. Joyce**, et al., *Betelgeuse, Betelgeuse, Betelgeuse, Betel-buddy? Constraints on the Dynamical Companion to α Orionis from HST*, preprint DOI:10.48550/arXiv.2505.18375 (submitted, ApJ)

31. A. J. G. O'Grady, B. O'Connor, J. A. Goldberg, et al., *Betelgeuse's Buddy: X-Ray Constraints on the Nature of α Ori B*, 2025, ApJ DOI:10.3847/1538-4357/adff83

32. F. Liu, Y.-S. Ting, D. Yong, et al., *At least one in a dozen stars shows evidence of planetary ingestion*, 2024, Nature DOI:10.1038/s41586-024-07091-y

33. H. Netzel, L. Molnár, **M. Joyce**, *Detailed asteroseismic modelling of RR Lyrae stars with non-radial modes*, 2023, MNRAS DOI:10.1093/mnras/stad2611

34. A. S. Jermyn, E. B. Bauer, J. Schwab, et al., *Modules for Experiments in Stellar Astrophysics (MESA): Time-dependent Convection, Energy Conservation, Automatic Differentiation, and Infrastructure*, 2023, ApJS DOI: 10.3847/1538-4365/acae8d

35. S. Das, L. Molnár, G. B. Kovács, et al., *A theoretical framework for BL Her stars: III. A case study: Robust light curve optimization in the Large Magellanic Cloud*, 2025, A&A DOI:10.1051/0004-6361/202452182

36. T. Marchetti, C. I. Johnson, **M. Joyce**, et al., *Blanco DECam Bulge Survey (BDBS). V. Cleaning the foreground populations from Galactic bulge colour-magnitude diagrams using Gaia EDR3*, 2022, A&A DOI:10.1051/0004-6361/202243921

37. A. I. Karakas, G. Cinquegrana, **M. Joyce**, *The most metal-rich asymptotic giant branch stars*, 2022, MNRAS DOI:10.1093/mnras/stab3205

Publications led by other students (4)

38. B. Világos, B. Cseh, A. Yagüe López, et al., *Barium stars as tracers of s-process nucleosynthesis in AGB stars. III. Systematic deviations from the AGB models*, 2024, A&A DOI:10.1051/0004-6361/202450084

39. Y. Li, T. R. Bedding, D. Stello, et al., *A prescription for the asteroseismic surface correction*, 2023, MNRAS DOI:10.1093/mnras/stad1445

40. Y. Li, T. R. Bedding, S. J. Murphy, et al., *Discovery of post-mass-transfer helium-burning red giants using asteroseismology*, 2022, Nature Astronomy DOI:10.1038/s41550-022-01648-5

41. A. D. Rains, M. Žerjal, M. J. Ireland, et al., *Characterization of 92 southern TESS candidate planet hosts and a new photometric [Fe/H] relation for cool dwarfs*, 2021, MNRAS DOI:10.1093/mnras/stab1167

Contributing author publications (22)

42. L. Molnár, H. Netzel, M. Howell, C. Kalup, **M. Joyce**, *Matching seismic masses for RR Lyrae-type and oscillating red horizontal-branch stars in M4*, 2025, A&A DOI:10.1051/0004-6361/202452118

43. D. Huber, D. Slumstrup, M. Hon, et al., *Stellar Models are Reliable at Low Metallicity: An Asteroseismic Age for the Ancient Very Metal-poor Star KIC 8144907*, 2024, ApJ DOI:10.3847/1538-4357/ad7110

44. Y. Li, T. R. Bedding, D. Huber, et al., *Realistic Uncertainties for Fundamental Properties of Asteroseismic Red Giants and the Interplay between Mixing Length, Metallicity, and vmax*, 2024, ApJ DOI:10.3847/1538-4357/ad6c3e

45. S. Das, L. Molnár, S. M. Kanbur, et al., *A theoretical framework for BL Her stars. II. New period-luminosity relations in Gaia passbands*, 2024, A&A DOI:10.1051/0004-6361/202348280

46. A. Kunder, Z. Prudil, K. R. Covey, et al., *The Milky Way Bulge Extra-tidal Star Survey: BH 261 (AL 3)*, 2024, AJ DOI:10.3847/1538-3881/ad0cfc

47. E. Butler, A. Kunder, Z. Prudil, et al., *RR Lyrae Stars Belonging to the Candidate Globular Cluster Patchick 99*, 2024, ApJL DOI:10.3847/2041-8213/ad20e8

48. J. Tayar, Z. R. Claytor, Q. Fox, et al., *The Importance of Neural Network Hyperparameters in Determining Age Inference Quality*, 2023, RNAAS DOI:10.3847/2515-5172/ad16d3

49. D. Yong, F. Liu, Y.-S. Ting, et al., *C3PO: towards a complete census of co-moving pairs of stars. I. High precision stellar parameters for 250 stars*, 2023, MNRAS DOI:10.1093/mnras/stad2679

50. S. J. Murphy, T. R. Bedding, A. Gautam, **M. Joyce**, *A grid of 200 000 models of young δ Scuti stars using MESA and GYRE*, 2023, MNRAS DOI:10.1093/mnras/stad2849

51. L. Molnár, E. Plachy, A. Bódi, et al., *To grow old and peculiar: Survey of anomalous variable stars in M80 with age determinations using K2 and Gaia*, 2023, A&A DOI:10.1051/0004-6361/202346507

52. L. Molnár, C. Kalup, **M. Joyce**, *Asteroseismic sounding of bulge globular clusters with the Roman Space Telescope*, 2023, white paper DOI:10.48550/arXiv.2306.12459

53. B. Welch, D. Coe, E. Zackrisson, et al., *JWST Imaging of Earendel, the Extremely Magnified Star at Redshift $z = 6.2$*, 2022, ApJL DOI:10.3847/2041-8213/ac9d39

54. J. Tayar, F. D. Moyano, M. Soares-Furtado, et al., *Spinning up the Surface: Evidence for Planetary Engulfment or Unexpected Angular Momentum Transport?*, 2022, ApJ DOI:10.3847/1538-4357/ac9312

55. C. I. Johnson, R. M. Rich, I. T. Simion, et al., *Blanco DECam Bulge Survey (BDBS) IV: Metallicity distributions and bulge structure from 2.6 million red clump stars*, 2022, MNRAS DOI:10.1093/mnras/stac1840

56. E. H. Anders, A. S. Jermyn, D. Lecoanet, et al., *Schwarzschild and Ledoux are Equivalent on Evolutionary Timescales*, 2022, ApJL DOI:10.3847/2041-8213/ac5cb5

57. S. J. Murphy, T. R. Bedding, T. R. White, et al., *Five young δ Scuti stars in the Pleiades seen with Kepler/K2*, 2022, MNRAS DOI:10.1093/mnras/stac240

58. L. Molnár, A. Bódi, A. Pál, et al., *First Results on RR Lyrae Stars with the TESS Space Telescope: Untangling the Connections between Mode Content, Colors, and Distances*, 2022, ApJS DOI:10.3847/1538-4365/ac2ee2

59. T.-Z. Yang, Z.-Y. Zuo, G. Li, T. R. Bedding, S. J. Murphy, **M. Joyce**, *TIC 308396022: δ Scuti-γ Doradus hybrid with large-amplitude radial fundamental mode and regular g-mode period spacing*, 2021, A&A DOI:10.1051/0004-6361/202142198

60. J. C. Zinn, D. Stello, Y. Elsworth, et al., *The K2 Galactic Archaeology Program Data Release 3: Age-abundance Patterns in C1–C8 and C10–C18*, 2022, ApJ DOI:10.3847/1538-4357/ac2c83

61. L. Spina, Y.-S. Ting, G. M. De Silva, et al., *The GALAH survey: tracing the Galactic disc with open clusters*, 2021, MNRAS DOI:10.1093/mnras/stab471

62. M. R. Hayden, S. Sharma, J. Bland-Hawthorn, et al., *The GALAH survey: chemical clocks*, 2022, MNRAS DOI:10.1093/mnras/stac2787

63. D. L. Holdsworth, H. Saio, D. M. Bowman, et al., *Suppressed phase variations in a high amplitude rapidly oscillating Ap star pulsating in a distorted quadrupole mode*, 2018, MNRAS DOI:10.1093/mnras/sty248

Teaching Summary

Scope: 8 years of teaching and mentorship experience across four continents (North America, Europe, Australia, Africa).
Supervision: 6 graduate students (3 Ph.D., 1 M.S., 2 external Ph.D.) and 6 undergraduates as primary advisor; all projects integrate computation and research publication.
Courses: Full lecturer for upper-division and graduate-level computational astrophysics courses at the University of Wyoming and Australian National University.
Pedagogy: Program Director (2023, 2026) and Lead Instructor (2022–2026) for the international MESA Summer Schools, translating to hundreds of students mentored in high-performance computing and stellar modeling.
Recognition: Consistently rated "excellent" (5/5 median) in university teaching evaluations (Wyoming and ANU).

—Supervision of Higher Degree Research—

Primary supervisor of three University of Wyoming Ph.D. students:

Caleb Eastlund, Physics and Astronomy, January 2025–present

Eliza Frankel, Physics and Astronomy, January 2025–present

Joshua Wanninger, Physics and Astronomy, October 2024–present

Primary supervisor of AI Master's student Greg Saul, Computer Science, October 2024–present

External co-supervisor of Monash University Ph.D. student Giulia Cinquegrana, August 2020–June 2024

Primary supervisor of RSAA Ph.D. student Yixiao Zhou, March 2020–January 2021

Primary supervisor of RSAA Honours student Jianling Tang, January 2020–June 2021

—Supervision of Undergraduate Research—

Primary supervisor of the following University of Wyoming undergraduate students:

Ily Rubio, Physics and Astrophysics/Mathematics, August 2024–present

Greg Saul, Computer Science, August 2024–present

Rachel Lynn Wood, Physics and Astrophysics, August 2024–February 2025

Elena Payne, Mathematics and Statistics, August 2024–December 2024

Primary supervisor for Konkoly Observatory's Undergraduate Astronomy Demonstrators Program (year-long REU equiv.) student Anett Simon-Zsók, September 2022–August 2024

Primary supervisor for RSAA Summer Scholar program (REU equiv.) student Jianling "Janet" Tang, November 2020–January 2021, **resulted in student's publication**

—Full Course Lecturing—

University of Wyoming — **Physics 4840: Mathematical and Computational Methods II**, January–May 2025
received a median teaching evaluation score of 5 out of 5, corresponding to a rating of "excellent"

Australian National University — **Astronomy 3007: Stars**, February–June 2020

Australian National University — **Astronomy 3005: Supervised Undergraduate Research**, February–June 2021

—Summer Schools and Special Training—

MESA Summer Schools: Lead pedagogy & lecturer, 2022, 2024, 2025; Program Director 2023 and 2026.

—Guest Lecturing & Teaching Assistance—

University of Cape Town — Teaching assistant & contributing lecturer, computational astrophysics, February–April 2018

University of Cape Town — Guest lecturer, undergraduate astronomy year 3, March 2018

South African Astronomical Observatory — Guest Lecturer, NASSP Summer School, South Africa, January–February 2018

University of Cape Town via Dartmouth College — Teaching assistant, Dartmouth Foreign Studies Program, Cape Town, South Africa, January–March 2017

Dartmouth College — Teaching assistant, September 2013–July 2018

Talks and Public Profile

Press, Media, and Communications Achievements

* Featured in *Nature* profile of neurodivergent scientists *(upcoming)*
* Featured on Wyoming news program *Cowboy State Daily* to discuss NSF grant and how to determine stellar ages
- **featured in BBC science documentary series *Science's Greatest Mysteries***, US release 2024
* Winner, TASC6/KASC13 Best Talk Competition, postdoc category *Standing on the Shoulders of Giants: New Mass, Age, and Distance estimates for Betelgeuse*, July 2022
* Winner, European Astronomical Society's Best Poster Competition, *Gaia Revolutions in Milky Way Modeling*, June 2021
- Featured in *Sky & Telescope*: "How Big is Betelgeuse Really?" November 2020
- Television appearance on ABC News, Canberra, Australia, 2020
- Guest on popular podcasts, YouTube shows, radio, 2020
- Scientific work featured on CNN, Forbes, Newsweek, Astronomy Now, SkyNews, CNET, Phys.org, and others (see website), 2020
* Honorable Mention, American Astronomical Society's Chambliss Graduate Student Poster Competition, June 2016

Highlighted Research Talks

1. Invited **plenary speaker**, *State of the Field: Advances and Challenges in Low-mass Stellar Modeling*, TASC9/KASC16, Vienna, Austria, July 2025
2. Invited review talk, *A Review of One-Dimensional Parameterizations of Convection and Their Applications*, Nordita, Stockholm, Sweden, August 2024
3. Invited talk at the European Astronomical Society (EAS)'s general meeting, session on Betelgeuse, Krakow, Poland, July 2023
4. Harvard Institute for Theory and Computation (host: ITC), October 2022
5. Contributed talk selected for Cool Stars 21, Toulouse, France, July 2022. One of 40 highly competitive slots for a conference of ∼600 participants.
6. Invited review talk on the Mixing Length Theory of convection, KITP UCSB, November 2021
7. Invited lecturer on MESA and its applications, IAU 336 Special Skills session, KU Leuven, November 2021
8. Special two-hour seminar on Betelgeuse at Kamioka neutrino observatory, Japan, April 2021 (paid)
9. Invited speaker to the special session on Betelgeuse, Marcel Grossmann Meeting on General Relativity (MG16), July 2021

Invited Colloquia and Seminars (selected, last 5 years)

10. Engineering Sciences and Applied Math (ESAM), Northwestern University (host: Daniel Lecoanet), October 2025
11. Institute for Astronomy, University of Hawai'i (host: Yaguang Li and Department of Astronomy), October 2024
12. University of Arizona (host: Department of Astronomy), February 2023
13. The Ohio State University (host: Department of Astronomy), January 2023
14. University of Oregon (host: Department of Physics), January 2023
15. American Museum of Natural History (host: Joel Zinn), October 2022
16. Yale (host: Sarbani Basu), November 2020
17. UC Santa Cruz (host: Josiah Schwab), November 2020
18. Space Telescope Science Institute, (host: Kornpob Bhirombhakdi), November 2020
19. KIPAC Stanford (host: Alex Amon, October 2020)
20. University of Auckland (host: Jan Eldridge), October 2020
21. UW Madison (host: Rich Townsend), October 2020
22. KITP/UC Santa Barbara (host: Lars Bildsten), October 2020
23. Harvard (host: Selma de Mink), September 2020
24. Harvard Center for Astrophysics (host: Charlie Conroy), September 2020
25. UT Austin (host: Craig Wheeler), September 2020
26. Flatiron Institute (host: Dan Foreman-Mackey), September 2020
27. University of Sydney (host: Tim Bedding), February 2020
28. University of Tokyo (host: Ken'ichi Nomoto), January 2020
29. Heidelberg Institute for Theoretical Studies (host: Saskia Hekker), October 2020

My speaking portfolio also includes 20 other talks during the last 5 years, an additional 6 talks prior to 2020, and 9 invited and 7 contributed conference talks since 2017.

Notable Public Outreach Talks

- ***Astronomy on Tap*** public lecture, Budapest, Hungary, September 2019
  From Light to Insight: How computer modeling lets us watch stars die
- Public astronomy nights **outreach lecture series**, SAAO, Cape Town, South Africa, February 2018
  Stellar Stories: Filling in the Observational Gaps with Computer Models of Stars
- Guest on **World Wide AstroFest**, United Kingdom, November 2020 (paid)

Observing time

. **PI:** Hubble Space Telescope, DDT Cycle 32, *Far-UV Detection of the Low-mass Companion Responsible for Betelgeuse's Long Secondary Period*, December 2024

. Chandra X-Ray Observatory, DDT Cycle 26, *X-Ray detection of the low-mass companion responsible for Betelgeuse's long secondary period* Co-I (PI Anna O'Grady), December 2024

. CHARA Array, 2021A semester, *Angular sizes and oblateness of delta scuti pulsators observed by TESS* Co-I (PI Tim White)

. **PI:** SAAO-Sutherland 1.9m, SpUpNIC grating spectrograph, 7 nights, *Preliminary Spectra of Metal-Poor Stars with HST Parallaxes*, November 2017

. SAAO-Sutherland 1.9m, SpUpNIC grating spectrograph, 4 nights, September 2017

. SAAO-Sutherland 1m, SHOC SAAO CCD, 7 nights, July 2017

. MDM 1.3m, remote, 1 night, May 2017

Service

Refereeing and Grant Evaluation

I have refereed for *Nature*, *The Astrophysical Journal*, *Monthly Notices of the Royal Astronomical Society*, *Astrophysics & Space Science*, and *Frontiers in Astronomy and Space Science* (Review Editor in solar and stellar physics).

I have served as an evaluator for European Research Council **(ERC)** starting grants, the NASA Astrophysics Decadal Survey Precursor Science **(ADSPS)** program, the NASA Advanced Theory Program **(ATP)**, and the **NSF postdoctoral fellowships** review panel.

Conference and Program Organization

- **Upcoming program director for 2026 MESA Summer School**
  secured the bid and funding to host the 2026 MESA Summer School in Wyoming
- **Program Director**, MESA@Konkoly: the first MESA Summer School in Europe, Budapest, Hungary, August 2023
- Scientific Organizing Committee (SOC) *The Alpha Centauri System: Prospects for neighboring worlds*, Nice, France, June 2023
- Admissions Committee for the 2022, 2023 and 2025 MESA Summer Schools
- Logistics Committee for the 2022 MESA Summer School
- Teaching Assistant for the 2021 MESA Summer School
- Two-time volunteer lecturer and organizer at the National Astrophysics and Space Science Program (NASSP) Summer School, South African Astronomical Observatory & University of Cape Town, South Africa, 2017 and 2018

University Service

- University of Wyoming Faculty Senate: Alternate Senator for the School of Computing, 2025–present
- as a postdoc, I organized an international thesis committee and graduated a PhD student at the Research School of Astronomy and Astrophysics (RSAA) at ANU
- as a postdoc, I served as a full lecturer for Australian National University's stellar astrophysics course when the need unexpectedly arose
- MESA instructor, IAU 336 skills training session
- ARC Centre of Excellence ASTRO 3D Colloquium Committee, November 2020–May 2021
- RSAA computing time allocation committee, June 2019–May 2021
- RSAA hiring committee
- President of the Dartmouth chapter of the national organization Graduate Women in Science and Engineering (GWISE) and Dartmouth's representative to the multi-collegiate New England GWISE consortium, 2016–2017

Scientific Collaborations

. MESA developers team, August 2019–present

. Blanco DECam Bulge Survey (BDBS), August 2021–present

. *Asteroseismic Laboratories (SeismoLab)* affiliate researcher, Konkoly Observatory, Budapest, Hungary (September 2021–present)

. TESS Asteroseismic Science Operations Center (**TASOC**) Working Group 2, December 2020–present

. ASTRO3D ARC Centre of Excellence affiliate investigator, October 2019–June 2021

. GALactic Archaeology with HERMES (**GALAH**) collaboration; August 2020–June 2021

Professional Organizations

American Astronomical Society (AAS), 2021–present

Astronomical Society of Australia (ASA), 2019–2021

Australian National Institute for Theoretical Astrophysics (ANITA), 2019–2021

Workshops & Special Training

* **Munich Institute for Astro-, Particle and BioPhysics (MIAPbP) Program *Stellar Astrophysics***, August 2023
* **KITP Program *Probes of Transport in Stars***, by invitation, October–December 2021
* MESA Summer School, teaching assistant, August 2021
* TESS*ninja* 3 data sprint, University of Sydney, Sydney, Australia, February 2020
* Astrophysics of LIGO/Virgo sources in O3 era, participation by invitation, University of Tokyo IPMU, January 2020
* **MESA developers retreat at Sky House, Santa Barbara, CA, USA, October 2019 *by invitation from Lars Bildsten***
* Center for Scientific Computing Summer School, Espoo, Finland, Summer 2016
* MESA Summer School, student, August 2015

Software Development

I am a core member of the **MESA developers** team.

I am a contributor to the second generation of MIST (MESA Isochrones and Stellar Tracks) models.

I am the primary author and maintainer of the open-source Python package ^{1D}MESA2HYDRO^{3D}.

I have designed MESA-based exercises for undergraduate astronomy courses and written a range of publicly available visualization tools for stellar structure and evolution and asteroseismic data.
See https://github.com/mjoyceGR

Power user of several stellar evolution and related programs: MESA, GYRE, MIST, DSEP, YREC, Phantom

List of Referees

(1) Prof. Brian Chaboyer (PhD adviser)
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(6) Prof. Michael J. Ireland
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Testimonials from workplaces & collaborations also available from:

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