Jeremy G. Baier — Curriculum Vitae

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Education

PhD   **Sept. 2022 - Present**
Oregon State University   *Corvallis, Oregon*

MS Physics   **Sept. 2022 - Mar. 2025**
Oregon State University   *Corvallis, Oregon*

BA Mathematics and Physics   **May 2022**
Kenyon College   *Gambier, Ohio*

Research Projects

The NANOGrav 15 year data-set: Customized chromatic noise models: Co-leading this colloboration project with Bjorn Larsen, under the supervision of Dr. Jeffrey Hazboun, I have been developing a model selection framework to customize noise models for individual pulsars in NANOGrav's datasets. This model selection process uses the data to tailor a noise model for each pulsar, paying special attention to frequency dependent effects such as scattering and dispersive delays in interstellar and interplanetary media.

Tuning a pulsar timing array in the detection era: Working under Dr. Jeffrey Hazboun, I implement simulation software inside of `hasasia` to optimize pulse timing array observations for the detection of the gravitational wave background or single sources of gravitational waves using realistic populations of supermassive black hole binaries.

Pulsar timing red noise with the NICER X-ray telescope: Working with the NICER high precision timing working group, I am studying red noise in millisecond pulsars using X-ray data from the NICER telescope. This project is supervised by Dr. Andrea Lommen at Haverford College and Dr. Paul Ray at the Naval Research Laboratory.

Gravitational wave tails: Working with Dr. Leslie and Madeline Wade at Kenyon college alongside Dr. Craig Copi and Dr. Glenn Starkman at Case Western, I performed a study of LIGO events searching for gravitational wave tails – gravitational waves scattered off of massive objects.

Neutron star equation of state: Working with Dr. Leslie Wade at Kenyon College, I implemented parameterized equation of state models in LIGO's parameter estimation software. These models allow for direct Bayesian inference on the neutron star equation of state using binary neutrons star merger data.

Funding & Awards

Oregon Lottery Graduate Scholarship   *2024*
   ($3,000)
NASA Oregon Space Grant Consortium Graduate Fellowship   *2023*
   ($10,000)
APS DGRAV Travel Award   *2022*
   ($300)
Kenyon Summer Sciences Grant   *2021*
   ($4,000)
Kenyon Summer Sciences Grant   *2020*

(retracted due to Covid-19)

Observing Proposals

Co-I: "The North American Nanohertz Observatory for Gravitational Waves"   *January 2024*
- Greenbank Telescope, GBT/24B-427
- Status: awarded 2205.0 hours

Co-I: "The North American Nanohertz Observatory for Gravitational Waves"   *January 2024*
- Very Large Array, VLA/24B-429
- Status: awarded 168.0 hours

Co-I: "Anomalous Mode Changing in the High-Precision Millisecond Pulsar J1909-3744"   *January 2025*
- Greenbank Telescope, GBT/25B-206
- Status: awarded 2.0 hours

Co-I: "No Pulsar Left Behind: Confirmation of Student-Discovered Pulsar Candidates"   *July 2024*
- Greenbank Telescope, GBT/25A-369
- Status: awarded 20.0 hours

Publications

Published...

20. *Rapid construction of joint pulsar timing array data sets: the Lite method.*
    B. Larsen, [...], **J. G. Baier**, et al. [43 Authors]
    Monthly Notices of the Royal Astronomical Society, **542**, 4, (2025)

19. *The NANOGrav 15 yr Data Set: Search for Gravitational-wave Memory.*
    Gabriella Agazie, [...], **J. G. Baier**, et al. [105 Authors]
    The Astrophysical Journal, **987**, 1, (2025)

18. *Search for Gravitational Waves Emitted from SN 2023ixf.*
    A. G. Abac, [...], **J. G. Baier**, et al. [200 Authors]
    The Astrophysical Journal, **985**, 2, (2025)

17. *The NANOGrav 15 yr Data Set: Harmonic Analysis of the Pulsar Angular Correlations.*
    Gabriella Agazie, [...], **J. G. Baier**, et al. [107 Authors]
    The Astrophysical Journal, **985**, 1, (2025)

16. *A sensitivity curve approach to tuning a pulsar timing array in the detection era.*
    Jeremy G. Baier, Jeffrey S. Hazboun, Joseph D. Romano
    Classical and Quantum Gravity, **42**, 7, (2025)

15. *Search for Continuous Gravitational Waves from Known Pulsars in the First Part of the Fourth LIGO-Virgo-KAGRA Observing Run.*
    A. G. Abac, [...], **J. G. Baier**, et al. [200 Authors]
    The Astrophysical Journal, **983**, 2, (2025)

14. *The NANOGrav 15 yr dataset: Posterior predictive checks for gravitational-wave detection with pulsar timing arrays.*
    Gabriella Agazie, [...], **J. G. Baier**, et al. [104 Authors]
    Physical Review D, **111**, 4, (2025)

13. *Swift-BAT GUANO Follow-up of Gravitational-wave Triggers in the Third LIGO–Virgo–KAGRA Observing Run.*
    Gayathri Raman, [...], **J. G. Baier**, et al. [200 Authors]
    The Astrophysical Journal, **980**, 2, (2025)

12. *The NANOGrav 15 yr Data Set: Running of the Spectral Index.*
    Gabriella Agazie, [...], **J. G. Baier**, et al. [105 Authors]
    The Astrophysical Journal Letters, **978**, 2, (2025)

11. *The NANOGrav 15 Yr Data Set: Removing Pulsars One by One from the Pulsar Timing Array.*
    Gabriella Agazie, [...], **J. G. Baier**, et al. [105 Authors]
    The Astrophysical Journal, **978**, 2, (2025)

10. *The NANOGrav 15 yr Data Set: Looking for Signs of Discreteness in the Gravitational-wave Background.*
    Gabriella Agazie, [...], **J. G. Baier**, et al. [100 Authors]
    The Astrophysical Journal, **978**, 1, (2025)

9. *A Search Using GEO600 for Gravitational Waves Coincident with Fast Radio Bursts from SGR 1935+2154*.
   A. G. Abac, [...], **J. G. Baier**, et al. [200 Authors]
   The Astrophysical Journal, **977**, 2, (2024)

8. *Search for Eccentric Black Hole Coalescences during the Third Observing Run of LIGO and Virgo*.
   A. G. Abac, [...], **J. G. Baier**, et al. [200 Authors]
   The Astrophysical Journal, **973**, 2, (2024)

7. *Search for Gravitational-lensing Signatures in the Full Third Observing Run of the LIGO–Virgo Network*.
   R. Abbott, [...], **J. G. Baier**, et al. [200 Authors]
   The Astrophysical Journal, **970**, 2, (2024)

6. *Observation of Gravitational Waves from the Coalescence of a 2.5–4.5 $M_\odot$ Compact Object and a Neutron Star*.
   A. G. Abac, [...], **J. G. Baier**, et al. [200 Authors]
   The Astrophysical Journal Letters, **970**, 2, (2024)

5. *Ultralight vector dark matter search using data from the KAGRA O3GK run*.
   A. G. Abac, [...], **J. G. Baier**, et al. [200 Authors]
   Physical Review D, **110**, 4, (2024)

4. *The NANOGrav 15 yr Data Set: Search for Transverse Polarization Modes in the Gravitational-wave Background*.
   Gabriella Agazie, [...], **J. G. Baier**, et al. [100 Authors]
   The Astrophysical Journal Letters, **964**, 1, (2024)

3. *Search for subsolar-mass black hole binaries in the second part of Advanced LIGO's and Advanced Virgo's third observing run*.
   LVK Collaboration, [...], **J. G. Baier**, et al. [200 Authors]
   Monthly Notices of the Royal Astronomical Society, **524**, 4, (2023)

2. *Open Data from the Third Observing Run of LIGO, Virgo, KAGRA, and GEO*.
   R. Abbott, [...], **J. G. Baier**, et al. [200 Authors]
   The Astrophysical Journal Supplements, **267**, 2, (2023)

1. *Model-based Cross-correlation Search for Gravitational Waves from the Low-mass X-Ray Binary Scorpius X-1 in LIGO O3 Data*.
   R. Abbott, [...], **J. G. Baier**, et al. [200 Authors]
   The Astrophysical Journal Letters, **941**, 2, (2022)

Submitted

4. *Inferring Mbh-Mbulge Evolution from the Gravitational Wave Background*.
   Cayenne Matt, [...], **J. G. Baier**, et al. [107 Authors]
   Arxiv:2508.18126

3. *The NANOGrav 15 yr Data Set: Targeted Searches for Supermassive Black Hole Binaries*.
   Nikita Agarwal, [...], **J. G. Baier**, et al. [119 Authors]
   Arxiv:2508.16534

2. *Search for solar axions produced through the axion-electron coupling g_{ae} using a new GridPix detector at CAST*.
   K. Altenmüller, [...], **J. G. Baier**, et al. [64 Authors]
   Arxiv:2505.05909

1. *Galaxy Tomography with the Gravitational Wave Background from Supermassive Black Hole Binaries*.
   Yifan Chen, [...], **J. G. Baier**, et al. [110 Authors]
   Arxiv:2411.05906

In Prep

5. *The NANOGrav 12.5-year Data Set: Chromatic Noise Characterization & Mitigation with Time-Domain Kernels*.
   Joseph Simon, Jeff Hazboun, Bjorn Larsen, Jeremy Baier
   In Preparation

4. *The NANOGrav 15-year Data Set: Customized Chromatic Noise Models*.
   Jeremy Baier, Bjorn Larsen, Joseph Simon, Jeff Hazboun, Daniel Oliver
   In Preparation

3. *The NICER 7.9 year dataset – A Detection of Red Noise in B1937-21*.
   Kalista Wayt, Jeremy Baier, Jeff Hazboun, The NICER Collaboration
   In Preparation

2. *Improvements to Calculations of Stochastic GWB Sensitivity Curves.*
   Daniel and Oliver, Kyle Gourlier, Martine Maggi, Jeremy Baier, Jeff Hazboun
   In Preparation
1. *The NANOGrav 15-year Data Set: Gravitational Wave Results with Customized Chromatic Noise Models.*
   J. G. Baier, et al. [6 Authors]
   In Preparation

Teaching & Mentoring

Teaching Assistant Positions

- **Graduate Teaching Assistant**, Oregon State University,   Fall 2022 - Present
  Descriptive Astronomy, General Physics III
- **Teaching Assistant**, Kenyon College,   Spring 2020 - Spring 2022
  General Physics I, General Physics II, Fields and Spacetime
  Graded student work and maintained gradebook.

Curriculum Development

- **PH104 Descriptive Astronomy**, Oregon State University,   Spring 2023
  Rewrote the laboratory curriculum to include more hands-on activities
  and incorporate simulated experiments with `Universe Sandbox`.
  Added a new laboratory on general relativity and gravitational waves.

Undergraduate Student Research Mentoring

- *Stephanie Poole*, Oregon State University   2025
  "Searching for a turnover in the NANOGrav 20 year data set"
- *Kyle Gourlie*, Oregon State University   2024
  "Variance in PTA sensitivity curves"
- *Rodney Downer*, Oregon State University   2023
  "LISA multi-messenger pipeline"

NANOStars Mentoring Program

- Teach undergraduate students the basics of pulsar timing and pulsar candidate ranking.   *September 2023-Present*

Leadership & Professional Service

Research leadership

- NANOGrav Timing/Detection Working Group Liaison   *May 2025-Present*

Reviewer for international journals

- Astronomy & Astrophysics

Committees

- Instructor Hiring Committee at Oregon State   *Fall 2024*

Conference organization

- Committee Member, Scientific Organizing Committee, IPTA Meeting, Caltech, Pasadena, CA
  June 2025,

Professional Affiliations

- North American Nanohertz Observatory for Gravitational waves (NANOGrav), *Full Member*
- International Pulsar Timing Array (IPTA), *Member*
- NICER high precision timing working group, *Member*
- LISA Consortium, *Community Member*
- American Physical Society (DGRAV), *Member*
- American Astronomical Society (AAS), *Member*
- LIGO Scientific Collaboration, *Former Member (2021-2023)*

Outreach

Outreach Projects

○ *Astronomy on Tap Corvallis Lecture Series*   *Fall 2023 – Present*
  Bombs Away Cafe, Second Tuesday of the Month
  500+ Attendees and counting

Outreach Talks

○ Brother Martin High School, *"A New Window to the Universe"*   *January 2024*

Software Development

Lead Developer

`hasasia`
  ○ *Python package for calculating and simulating pulsar timing array sensitivity.*
  ○ https://hasasia.readthedocs.io/en/latest/

Contributing Developer

`ENTERPRISE`
  ○ *A pulsar timing analysis code, aimed at noise analysis and gravitational-wave searches.*
  ○ https://github.com/nanograv/enterprise

`PINT`
  ○ *A project to develop a new pulsar timing solution based on python and modern libraries.*
  ○ https://nanograv-pint.readthedocs.io/en/latest/

`pint_pal`
  ○ *A repository for standardizing timing analysis and data combination work with a Jupyter notebook framework.*
  ○ https://github.com/nanograv/pint_pal

`discovery`
  ○ *Next-generation pulsar timing array data analysis software*
  ○ https://github.com/nanograv/discovery

`Bilby`
  ○ *A user-friendly Bayesian inference library.*
  ○ https://github.com/lscsoft/bilby

`LALsuite`
  ○ *LIGO algorithm library.*
  ○ https://github.com/lscsoft/lalsuite

Presentation List

Contributed presentations

12. *The NANOGrav 15 year data-set: Customized chromatic noise models*
    International Pulsar Timing Array Meeting, Pasadena, California, June 2025

11. *Noise in the NANOGrav 20 year dataset*
    NANOGrav Spring Meeting, *Virtual*, April 2025

10. *The NANOGrav 15 year data-set: Customized chromatic noise models*
    APS Global Summit, Anaheim, California, March 2025

9. *The NANOGrav 15 year data-set: Customized chromatic noise models*
   NANOGrav Fall Meeting, Ann Arbor, Michigan, October 2024

8. *The NANOGrav 15 year data-set: Customized chromatic noise models*
   International Pulsar Timing Array Meeting, Sesto, Italy, June 2024

7. *Chromatic Noise Modeling of Pulsars in NANOGrav's 15-year Dataset*
   NASA Oregon Space Grant Consortium Symposium, Corvallis, Oregon, May 2024

6. *Continuous gravitational wave detection forecasting tools from pulsar timing array sensitivity*
   American Physical Society Meeting, Sacramento, California, April 2024

5. *"Tuning" a PTA to continuous waves*
   NANOGrav Spring Meeting, Virtual, March 2024

4. *The NANOGrav 15-year dataset: Customized chromatic noise models*
   NANOGrav Fall Meeting, Vancouver, British Columbia, October 2024

3. *Modeling single source sensitivity with hasasia and holodeck*
   International Pulsar Timing Array Meeting, Port Douglas, Australia, June 2023

2. *Implementing a Dynamic Polytrope model of Neutron Star Equation of State in BILBY*
   American Physical Society April Meeting , New York City, New York, April 2022

1. *Constraining the Neutron Star Equation of State*
   Kenyon College Senior Capstone, Gambier, Ohio, March 2022

Posters

5. *Chromatic Noise Modeling of Pulsars in NANOGrav's 15-year Dataset*
   NASA Oregon Space Grant Consortium Symposium, Corvallis, Oregon, May 2024

4. *The NANOGrav 15 year data-set: Customized chromatic noise models*
   APS April Meeting, Sacramento, California, April 2024

3. *Customized chromatic noise models for pulsars in NANOGrav's 15-year dataset*
   243rd American Astronomical Society Meeting, New Orleans, Louisiana, January 2024

2. *Implementing parameterized equation of state models in BILBY*
   Ligo-Virgo-Kagra Collaboration Meeting, Evanston, Illinois March 2023

1. *Contraining the Neutron Star Equation of State*
   Kenyon College Summer Science Fair, Gambier, Ohio, September 2021

Conferences

17. Oregon Astronomy Research Symposium
    Eugene, Oregon, September 2025

16. International Pulsar Timing Array Meeting
    Pasadena, California, June 2025

15. NANOGrav Spring Meeting
    virtual, April 2025

14. American Physical Society Global Summit
    Anaheim, California, March 2025

13. NANOGrav Fall Meeting
    Ann Arbor, Michigan, October 2024

12. International Pulsar Timing Array Meeting
    Sexten, Italy, June 2024

11. NASA Oregon Space Grant Consortium Symposium
    Corvallis, Oregon, May 2024

10. American Physical Society April Meeting
    Sacramento, California, April 2024

9. NANOGrav Spring Meeting
   virtual, March 2024

8. 243rd American Astronomical Society Meeting
   New Orleans, Louisiana, January 2024

7. NANOGrav Collaboration Meeting
   Vancouver, British Columbia, October 2023

6. ALAMDI15: The Broad Reach of Gravitational Wave Science
   virtual, July 2023

5. International Pulsar Timing Array Meeting
   Port Douglas, Australia, June 2023

4. NANOGrav Collaboration Meeting
   Corvallis, Oregon, March 2023

3. Ligo-Virgo-Kagra Collaboration Meeting
   Evanston, Illinois, March 2023

2. APS April Meeting
   New York, April 2022

1. ALMALDI14: Conference on Gravitational Waves
   virtual, July 2021

References

- **Dr. Jeffrey Hazboun** *Graduate Research Advisor*
  Professor of Physics
  Oregon State University, Corvallis, OR 97331
  email: `jeffrey.hazboun@oregonstate.edu`

- **Dr. Xavier Siemens** *NANOGrav PI*
  Professor of Physics
  Oregon State University, Corvallis, OR 97331
  Phone: 541-737-7512   *email:* `xavier.siemens@oregonstate.edu`

- **Dr. Leslie Wade** *Undergraduate Advisor*
  Professor of Physics
  Kenyon College, Gambier, OH 43022
  Phone: 740-427-5356   *email:* `wadel@kenyon.edu`

- **Dr. Madeline Wade**
  Professor of Physics
  Kenyon College, Gambier, OH 43022
  Phone: 740-427-5268   *email:* `wadem@kenyon.edu`