

Jeffrey S. Hazboun

Curriculum Vitae

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ACADEMIC POSITIONS

- **NANOGrav Physics Frontiers Center Senior Postdoctoral Fellow**
University of Washington Bothell, August 2018 - Present
- **NANOGrav Physics Frontiers Center Postdoctoral Fellow**
University of Texas Rio Grande Valley, August 2016 - July 2018
- **Visiting Assistant Professor**
Hendrix College, August 2015-July 2016
- **Postdoctoral Teaching Position/ Head Online Class Developer**
Utah State University, Logan UT September 2014 - August 2015
- **Visiting Scholar**
Center for Relativistic Astrophysics, Georgia Tech
Atlanta, Georgia, June 2012 - May 2013

EDUCATION

- **PhD Physics** December 2014
"Conformal gravity and time"
Advisor: James T. Wheeler
Utah State University, Logan, Utah
- **MS Physics (Mathematics Minor)** June 2008
"The effects of negative-energy shells on Schwarzschild spacetime"
Advisor: Tevian Dray
Oregon State University, Corvallis, Oregon
- **BS Biology** December 1999
State University of New York, College of Environmental Science and Forestry, Syracuse, New York

RESEARCH INTERESTS

Gravitational wave astronomy with pulsar timing arrays and space-based detectors (LISA), pulsars and the interstellar medium, multi-messenger astronomy, cosmology, theoretical relativity and geometry

PROFESSIONAL SOCIETIES AND COLLABORATIONS

- North American Nanohertz Observatory for Gravitational Waves Collaboration
- International Pulsar Timing Array Collaboration
- International Gravitational Outreach Group
- LISA Consortium
- Neutron star Interior ExploreR (NICER) Timing Working Group
- American Physical Society
- American Astronomical Society

TEACHING EXPERIENCE

- Teaching Positions

- **Visiting Assistant Professor**, Hendrix College, Conway, Arkansas, Fall 2015 - Spring 2016
Astronomy, Cosmology, Quantum Mechanics and General Physics I
Mentored 4 undergraduate researchers.
- **Physics Instructor**, Utah State University, Logan, Utah, Spring 2015
General Physics II: Instructor of Record for a 165 person Physics for the Life Sciences class. Supervised nine teaching assistants.
- **Astronomy Instructor**, Utah State University, Logan, Utah, Fall 2014
Instructor of record for a 300+ person astronomy class. Supervised two teaching assistants.
- **Research Advisor**, Utah State University, Logan, Utah, Fall 2013-Spring 2014
Mentored a senior research project on multi-messenger astronomy using gravitational waves.
- **Online Physics Course Developer & Instructor**, Utah State University, Logan, Utah, 2012-2014
The Universe: Proposed, developed and taught an online cosmology class for non-science students. Continuously offered for the last 7 semesters. Over 400 students have taken this class.
- **Physics Instructor**, Utah State University, Logan, Utah, Summer 2011
General Physics I: Instructor of Record
- **Teaching Assistant**, Utah State University, Logan, Utah, Fall 2009-Spring 2012
General Physics I: Recitation Leader and Lab Instructor
General Physics II: Recitation Leader and Lab Instructor
- **Teaching Assistant**, Oregon State University, Corvallis, Oregon Fall 2006-Spring 2009
Paradigms in Physics TA: NSF funded higher division class reform project.
Facilitated group work and took part in curriculum meetings.
Physics for the Life Sciences: Recitation Leader and Lab Instructor
General Physics II: Lab Instructor
- **MCAT Physics Instructor** Princeton Review, Portland, Oregon, Summer 2007
Developed curriculum to help students review for physics portion of the MCAT exam.
Taught students test-taking strategies to prepare for a stressful and fast-paced exam.
- **Courses Instructed**, *Textbook* (Students \times Credit Hours) [cumulative]
 - Quantum Mechanics, *Griffiths* (39 hrs)
 - Cosmology, *Ryden* (27 hrs)
 - Astronomy, *Bennett, et al.* (1300 hrs)
 - The Universe, *Ratcliffe* (1200 hrs)
 - Physics for the Life Sciences 1, *Cutnell & Johnson* (75 hrs)
 - Physics for the Life Sciences 2, *Cutnell & Johnson* (450 hrs)
 - Physics for Engineers 1, *Halliday & Resnick* (75 hrs)

LEADERSHIP & SERVICE

- Data Challenge Working Group Co-Chair, International Pulsar Timing Array
- Diversity and Equity Group Co-Chair, International Gravitational Outreach Group
- Local Organizing Committee, Conferences for Undergraduate Women in Physics at Seattle
- Local Organizing Committee Chair, NANOGrav Spring Meeting 2019
- LISA Data Analysis Workshop, AAS233 2019
- Science Organizing Committee, LISA Symposium 2018
- Science Organizing Committee, NANOGrav Spring Meeting 2018
- Science Organizing Committee, NANOGrav Spring Student Workshop 2018

- Student Workshop Organizer, IPTA Meeting 2017
- Referee for American Astronomical Society Journals
- Referee for Monthly Notices of the Royal Astronomical Society
- Referee for Classical and Quantum Gravity
- Referee for General Relativity and Gravitation
- Referee for Physical Review
- Referee for European Journal of Physics

SOFTWARE DEVELOPMENT ---

Lead Developer

- **hasasia** Python package for calculating pulsar timing array sensitivity curves and signal-to-noise ratios.
<https://pypi.org/project/hasasia/>
- **Pulsar Data Toolbox** Python package for accessing pulsar data files.
<https://pypi.org/project/pdat/>
- **Pulsar Signal Simulator** Python package for simulating pulsar observation data.
<https://github.com/PsrSigSim/PsrSigSim>
- **La Forge** Python package for making plots from Bayesian analyses of PTA data.
<https://pypi.org/project/la-forge/>

Development Team

- **enterprise** Python package for bayesian PTA data analysis.
<https://github.com/nanograv/enterprise>
- **enterprise_extensions** Python package for building bayesian analysis models.
https://github.com/stevertaylor/enterprise_extensions
- **Tabletop PTA** Python package for an acoustical PTA demonstration.
https://pypi.org/project/tabletop_pta/

ADVANCED GRADUATE SCHOOLS ---

- **53rd Cracow School of Theoretical Physics** Zakopane, Poland. June 2013
Eight day school. Topics: conformal symmetry, AdS/CFT, and quantum gravity.
- **Higher Gauge Theory, Topological Quantum Field Theory and Quantum Gravity School and Workshop** Lisbon, Portugal, February 2011
Seven day school. Topics: topology, category theory and quantum gravity.
- **PASI Quantum Gravity Summer School** Morelia, Mexico, June 2010
Ten day school. Topics: various approaches to quantum gravity lectured.

INVITED TALKS ---

• Professional

15. **Montana State University Physics Colloquium** Nov, 2019
Exploring the discovery space of pulsar timing arrays with realistic sensitivity curves
14. **GR22/Amaldi13** July, 2019
Education and Public Outreach Efforts by Pulsar Timing Array Collaborations
13. **Northwest APS Meeting** PTA Overview, May, 2019
*The Search for Lumbering Giants:
Observing the Nanohertz Gravitational-Wave Sky with Pulsar Timing Arrays*

12. **Gravitational Wave Physics and Astronomy Workshop** PTA Overview, December, 2019
Current Status of Pulsar Timing Array Gravitational Wave Astronomy
11. **University of Washington Bothell** PSD Seminar, December, 2018
Observing the Nanohertz Gravitational-Wave Sky with Pulsar Timing Arrays
10. **University of Washington Seattle** AstroLunch Talk, February, 2018
A Galactic Scale Gravitational Wave Detector: The NANOGrav 11yr Limits
9. **University of Washington Bothell** PSD Seminar, November, 2017
*The NANOGrav Pulsar Timing Array:
Using simulations to characterize our galactic gravitational wave detector.*
8. **University of Texas Rio Grande Valley** ARCC Meeting, February, 2017
Simulating Pulsar Signals for Noise Characterization of PTAs
7. **University of Arkansas** Colloquium, February, 2016
Gravitational Wave Astronomy in the 2nd Century of GR
6. **Western Washington University** Colloquium, May, 2015
A New Window into the Cosmos
5. **Brigham Young University** Theory Seminar, February, 2015
Gravitational Gauge Theory and the Dark Cosmological Constituents
4. **Center for Relativistic Astrophysics** Departmental Colloquium, March, 2013
Biconformal Space & Testing Alternative Theories of Gravity using Multi-Messenger Astronomy
3. **Utah State University** Colloquium, February, 2013
Best Practices for the Online Classroom
2. **Utah State University** Colloquium, September 2010
Curved Phase Space from conformal symmetry
1. **Oregon State Physics Colloquium** Corvallis, Oregon, March 2009
Spherical Shells in a Schwarzschild Background

- **Public**

7. **Science Wednesday Panel Discussion** King's Live Music, Conway, Arkansas, February 2015
The Science of Time Travel
6. **Science Fiction Club Talk** Hendrix College, Conway, Arkansas, October 2015
Black Holes and Wormholes
5. **Science Unwrapped** Utah State University, Logan, Utah, February 2013
Explore to Conserve (500 person public lecture)
4. **Conservation Club Talk** Weber State Conservation Club, Ogden, Utah, February 2012
A Scientist's Role in Conservation
3. **Science Unwrapped** Swaner Ecocenter, Park City, Utah, February 2011
A Scientist's Role in Modern Exploration
2. **Science Interview for National Geographic**, November 2009
Interviewed for *Phenomena: A science salon hosted by National Geographic* about the physics in the movie "Men Who Stare at Goats".
1. **Cache Valley Stargazers Talk** Logan, Utah, November 2009
Black Holes: Ninjas of the Night Sky

RESEARCH TALKS PRESENTED

36. **Fall NANOGrav Meeting** Ithaca, NY, October, 2019
"Modeling Astrophysical Noise Sources in PTAs"
 Jeffrey S. Hazboun
35. **GR22/Amaldi13** Valencia, Spain, July, 2019
"Realistic Pulsar Timing Array Sensitivity Curves"
 Jeffrey S. Hazboun , Joseph D. Romano, Tristan L. Smith
34. **American Physical Society April Meeting** Denver, Colorado, April, 2019
"Pulsar Timing Array Sensitivity Curves"
 Jeffrey S. Hazboun, Joseph D. Romano, Tristan L. Smith
33. **Spring NANOGrav Meeting** Bothell, Washington, March, 2019
"Characterizing the Sensitivity of the NANOGrav 11-year Data Set"
 Jeffrey S. Hazboun
32. **American Astronomical Society Meeting** Seattle, Washington, January, 2019
"Bayesian Monitoring of Solar Electron Density Using NANOGrav Data sets"
 Jeffrey S. Hazboun
31. **AstroNWxSW** Vancouver, British Columbia, November, 2018
"Bayesian Monitoring of the Solar Wind with Pulsar Timing Arrays"
 Jeffrey S. Hazboun
30. **Fall NANOGrav Meeting** Green Bank, West Virginia, October, 2018
"Spurious Gravitational Wave Detections in the NANOGrav 11 Year Data Set"
 Jeffrey S. Hazboun
29. **LISA Symposium** Chicago, Illinois, July, 2018
"The International Pulsar Timing Array Mock Data Challenge"
 Jeffrey S. Hazboun on behalf of the IPTA Data Challenge Working Group
28. **IPTA 2018** Albuquerque, New Mexico, June, 2018
"Evolution of the Detection Statistics in the NANOGrav Dataset"
 Jeffrey S. Hazboun
27. **Northwest Section APS Meeting** Tacoma, Washington, June, 2018
"Noise Evolution in the NANOGrav 11 Year Data Set"
 Jeffrey S. Hazboun
26. **Python in Astronomy** New York, New York, May, 2018
"Publishing a Gravitational Wave Stochastic Background Analysis"
 Jeffrey S. Hazboun
25. **American Physical Society April Meeting** Columbus, Ohio, April, 2018
"Slicing the NANOGrav 11 Year Data Set"
 Jeffrey S. Hazboun
24. **Spring NANOGrav Meeting** Charlottesville, Virginia, March, 2018
"Evolution of the NANOGrav 11 Year Data Set"
 Jeffrey S. Hazboun
23. **Fall NANOGrav Meeting** Easton, Pennsylvania, October, 2017
"Slicing the NANOGrav 11 Year Data Set"
 Jeffrey S. Hazboun
22. **International Pulsar Timing Array** Sèvres, France, July, 2017
"The NANOGrav pulsar signal simulator"
 Jeffrey S. Hazboun
21. **American Physical Society April Meeting** Washington, DC, January, 2017
"Late-time quadrupolar gravitational wave power in de Sitter space"
 Jeffrey S. Hazboun and Béatrice Bonga

20. **American Astronomical Society 227th Meeting** Grapevine, Texas, January, 2017
"Null Stream Approach with PTAs: Noise Characterization and Excess Power"
 Jeffrey S. Hazboun
19. **Fall NANOGrav Meeting** Urbana, Illinois, October, 2016
"Assessing the null stream approach for source localization in PTAs"
 Jeffrey S. Hazboun
18. **Int. Soc. for General Relativity and Gravitation 21st Meeting** New York City, New York, July, 2016
"Comparing transverse-traceless decompositions of symmetric tensors"
 Jeffrey S. Hazboun and Béatrice Bonga
17. **American Physical Society April Meeting** Salt Lake City, Utah, April, 2016
"Null Stream Approach for finding Sky Position of Pulsar Timing Array sources"
 Jeffrey S. Hazboun and Shane L. Larson
16. **Midwest Gravity Meeting** Evanston, Illinois, October, 2015
"A Cartan Geometry approach to the AdS/CFT "
 Jeffrey S. Hazboun
15. **American Physical Society April Meeting** Baltimore, Maryland, April 2015
"Tracing the AdS/CFT Degrees of Freedom using Cartan Geometry"
 Jeffrey S. Hazboun
14. **American Astronomical Society 225th Meeting** Seattle, Washington, January 2015
"Pulsar Timing Array Source Location Using the Null Signal Approach" (Poster)
 Jeffrey S. Hazboun and Shane L. Larson
13. **Midwest Gravity Meeting** Rochester, MI, November, 2014
"Conformal gravity, dark matter and time"
 Jeffrey S. Hazboun and James T. Wheeler
12. **APS Four Corners Meeting** Orem, Utah, October 2014
"Conformal gravity, dark matter and time"
 Jeffrey S. Hazboun and James T. Wheeler
11. **Midwest Gravity Meeting** Milwaukee, Wisconsin, October 2013
"Time from the conformal symmetries of a Euclidean space"
 Jeffrey S. Hazboun and James T. Wheeler
10. **Loops 13: International Conference on Quantum Gravity** Waterloo, Canada, July 2013
"Lorentzian geometry from the conformal symmetries of a Euclidean space"
 Jeffrey S. Hazboun and James T. Wheeler
9. **GR20/AMALDI 10** Warsaw, Poland, July 2013
"Testing Bimetric and Massive Gravity Theories using Multi-Messenger Astronomy"
 Jeffrey S. Hazboun and Shane L. Larson
8. **53rd Cracow School of Theoretical Physics** Zakopane, Poland, June 2013
"Lorentzian spin connection from the conformal symmetries of a Euclidean space"
 Jeffrey S. Hazboun and James T. Wheeler
7. **Pacific Coast Gravity Meeting** Davis, California, March 2013
"General relativity in signature changing phase space"
 Jeffrey S. Hazboun and James T. Wheeler
6. **Pacific Coast Gravity Meeting** Santa Barbara, California, March 2012
"General relativity in phase space with a natural notion of time"
 Jeffrey S. Hazboun and James T. Wheeler
5. **Loops 11: International Conference on Quantum Gravity** Madrid, Spain, May 2011
"A systematic construction of curved phase space: A gravitational gauge theory with symplectic form"
 Jeffrey S. Hazboun and James T. Wheeler

4. **Intermountain Graduate Research Symposium** Logan, Utah, March 2010
"Quantum gravity in relativistic phase space"
 Jeffrey S. Hazboun and James T. Wheeler
3. **12th Marcel Grossman Gravity Meeting** Paris, France, July 2009
"Multiple Spherical Shells in Schwarzschild Spacetime" (MS Work)
 Jeffrey S. Hazboun and Tevian Dray
2. **Pacific Coast Gravity Meeting** Eugene, Oregon, March 2009
"Single Spherical Shells in Schwarzschild Spacetime" (MS Work)
 Jeffrey S. Hazboun and Tevian Dray
1. **TEXAS Symposium on Relativistic Astrophysics** Vancouver, Canada, December 2008
"Multiple Spherical Shells in Schwarzschild Spacetime" (Poster, MS Work)
 Jeffrey S. Hazboun and Tevian Dray

STUDENT RESEARCH PROJECTS

- **Min Young Kim** University of Washington Seattle, 2018-Present
Bayesian Pulsar Timing
- **Kyle Gersbach** University of Washington Bothell, 2018-Present
Teaching with the Pulsar Signal Simulator
- **Jacob Hesse** University of Washington Bothell, 2017-2018
Efficiently Simulating NANOGrav Pulsars
- **Amelia Henkel** REU UT Rio Grande Valley, Brownsville, Texas, Summer 2017
Dispersing Simulated Baseband Pulsar Signals
- **Cassidy Wagner** REU UT Rio Grande Valley, Brownsville, Texas, Summer 2017
Simulating Interstellar Medium Effects with Convolution
- **Chris Griffin** Hendrix College, Conway, Arkansas, 2015-2016
Conformal Diagrams of Crossing Spherical Shells in Schwarzschild Spacetime
- **Devon Roell** Hendrix College, Conway, Arkansas, 2015-2016
The Quantum Exchange Force and Gravity
- **Eric Mullins**, Hendrix College, Conway, Arkansas, 2015-2016
Localizing Gravitational Wave Sources with Noisy Null Signals
- **Connor Nelson**, Hendrix College, Conway, Arkansas, 2015-2016
Localizing Multiple Gravitational Wave Sources with Null Signals
- **Manuel Pichardo Marcano** Utah State University, Logan, Utah, 2012-2013
Multi-messenger Pulsar Timing Array Sources and Propagation Tests

GRANTS, HONORS and AWARDS

1. **Amazon Web Services**, Research Grant 50,000 Credits, 2019
2. **USU College of Science Graduate Teacher of the Year**, 2013
3. **Graduate Student Senate: Graduate Enhancement Award**, \$4000, 2013
4. **Travel Grant and Support**, Loops '13, \$1000, 2013
5. **Travel Grant and Support**, 53rd Cracow School of Theoretical Physics, \$3000, 2013
6. **Gene Adams Endowed Scholarship**, \$400, Spring 2011
7. **Travel Grant and Support**, Higher Gauge Theory, Topological Quantum Field Theory and Quantum Gravity School and Workshop, \$1000, 2013
8. **Travel Grant and Support**, PASI Quantum Gravity Summer School, \$2000, 2013
9. **National Geographic Explorer's Grant**, Kamchatka Project Summer, \$25,000, 2010

10. **Howard L. Blood Scholarship**, \$4000, Summer 2010
11. **Sigma Pi Sigma Physics Honor Society**, April 2010
12. **Vice-President for Research Fellowship**, \$10,000, Fall 2009
13. **NSF Student Travel Grant**, \$2000, Summer 2009
14. **Finalist Fulbright Scholarship**, Spring 2009
15. **Fontana Travel Award**, \$375, December 2008
16. **Best Picture, National Paddling Film Festival, Amateur Category**, *Lemonade*, 2006

OUTREACH

See *Invited Lectures: Public* section above for more examples of outreach.

- **Tabletop PTA**, Sept 2017-Present
A table demonstration of how a pulsar timing array works using metronomes and smart phones.
- **Kamchatka Project Science Coordinator**, January 2009-2011
Outreach/Science coordinator for the Kamchatka Project, a National Geographic funded kayaking expedition to the Kamchatka Peninsula of far-east Russia.
- **Science Unwrapped Volunteer**, Jan 2009-2011
Answer questions about black holes and falling into black holes as part of public interactions after astrophysics themed talks.