Pinchen Fan

Department of Astronomy and Astrophysics
Penn State University
525 Davey Laboratory
251 Pollock Road
University Park, PA 16802

Email: pinchen@psu.edu
Website: https://pinchen.fan
Google Scholar
NASA ADS
ORCID: 0000-0003-3988-9022

Research Interests

Astrobiology, technosignatures (SETI), biosignatures, exoplanets

Gravitational waves, tests of general relativity, multi-messenger astronomy

Education

The Pennsylvania State University, University Park, PA
Ph.D. in Astronomy and Astrophysics, Dual-Title in Astrobiology — Expected 2027
Thesis advisor: Jason Wright
M.S. in Astronomy and Astrophysics — 2022–2024

Carleton College, Northfield, MN
B.A. in Physics, Minor in Mathematics, *magna cum laude* — 2018–2022

Appointments

Research Assistant, Penn State University — 2022–Present
Co-instructor of Astro 476 SETI, Penn State University — Fall 2023
Teaching Assistant, Penn State University — Fall 2022
Research Assistant, Massachusetts Institute of Technology — 2021–2022
Teaching Assistant, Carleton College — 2020–2022
Research Assistant, Carleton College — 2019–2022

Grants

"New Approaches to Laser and Radio Technosignatures", NASA Exoplanet Research Program, **Science PI: Pinchen Fan**, Admin PI: Jason Wright, $483,147, 2025-2027

"The Order of the Octopus SETI Conference", The Heising-Simons Foundation, **PI: Pinchen Fan**, $89,987, 2024

"The Order of the Octopus SETI Conference", $20,000 in-kind contribution awarded by the Green Bank Observatory for lodging and meals for all conference attendees at the observatory

Honors, Awards, and Fellowships

Zaccheus Daniel Fellowship, Penn State University — 2024
CPEST Travel Grant, Penn State University — 2024
Zaccheus Daniel Fellowship, Penn State University — 2023
PATHS STEAM Educational Grant, LGBT Tech — 2023
Homer F. Braddock/Nellie H. and Oscar L. Roberts Fellowship, Penn State University — 2022
Phi Beta Kappa Society Member — 2022

Sigma Xi The Scientific Research Honors Society Member	2022
Dean's List 2020–2021, Carleton College	2021
Parents Fund for Academic Excellence (Summer Research Fellowship), Carleton College	2021

Publications

Google Scholar, NASA ADS

Leading Author

2. **Pinchen Fan** and Jason T. Wright and T. Joseph W. Lazio, "Detecting Extraterrestrial Civilizations That Employ an Earth-level Deep Space Network", ApJL **990**, L1 (2025)

1. Anarya Ray, **Pinchen Fan**, and 5 other authors, "Measuring gravitational wave speed and lorentz violation with the first three gravitational-wave catalogs", Phys. Rev. D **110**, 122001 (2024), arXiv:2307.13099 [gr-qc]

Co-Author

2. Sofia Sheikh, Macy Huston, **Pinchen Fan**, and 5 other authors, "Earth detecting earth: at what distance could earth's constellation of technosignatures be detected with present-day technology?", AJ **169**, 118 (2025)

1. Muhammed Saleem and 19 other authors (incl. **Pinchen Fan**), "Demonstration of machine learning-assisted low-latency noise regression in gravitational wave detectors", Classical and Quantum Gravity **41**, 195024 (2024), arXiv:2306.11366 [gr-qc]

Collaboration Author (P. C. Fan)

In these papers, I am listed as an author because of my research as a LIGO-Virgo-KAGRA collaboration member.

16. A. Abac et al., *Ultralight vector dark matter search using data from the KAGRA O3GK run*, 2024, arXiv:2403.03004 [astro-ph.CO]

15. C. Fletcher et al., "A Joint Fermi-GBM and Swift-BAT Analysis of Gravitational-Wave Candidates from the Third Gravitational-wave Observing Run", The Astrophysical Journal **149**, 149 (2024)

14. R. Abbott et al., "Search for subsolar-mass black hole binaries in the second part of Advanced LIGO's and Advanced Virgo's third observing run", Monthly Notices of the Royal Astronomical Society **524**, 5984–5992 (2023)

13. A. G. Abac et al., *Search for Eccentric Black Hole Coalescences during the Third Observing Run of LIGO and Virgo*, 2023, arXiv:2308.03822 [astro-ph.HE]

12. R. Abbott et al., "Constraints on the Cosmic Expansion History from GWTC–3", The Astrophysical Journal **949**, 76 (2023)

11. R. Abbott et al., *Search for gravitational-lensing signatures in the full third observing run of the LIGO-Virgo network*, 2023, arXiv:2304.08393 [gr-qc]

10. R. Abbott et al., "Open data from the third observing run of LIGO, Virgo, KAGRA and GEO", The Astrophysical Journal Supplement Series **267**, 29 (2023)

9. R. Abbott et al., "Model-based Cross-correlation Search for Gravitational Waves from the Low-mass X-Ray Binary Scorpius X-1 in LIGO O3 Data", The Astrophysical Journal Letters **941**, L30 (2022)

8. R. Abbott et al., "All-sky search for continuous gravitational waves from isolated neutron stars using Advanced LIGO and Advanced Virgo O3 data", Phys. Rev. D **106**, 102008 (2022)

7. R. Abbott et al., "Search for gravitational waves from Scorpius X-1 with a hidden Markov model in O3 LIGO data", Phys. Rev. D **106**, 062002 (2022)

6. R. Abbott et al., "Search for continuous gravitational wave emission from the Milky Way center in O3 LIGO-Virgo data", Phys. Rev. D **106**, 042003 (2022)

5. R. Abbott et al., "Searches for Gravitational Waves from Known Pulsars at Two Harmonics in the Second and Third LIGO-Virgo Observing Runs", The Astrophysical Journal **935**, 1 (2022)

4. R. Abbott et al., "All-sky search for gravitational wave emission from scalar boson clouds around spinning black holes in LIGO O3 data", Phys. Rev. D **105**, 102001 (2022)

3. R. Abbott et al., "First joint observation by the underground gravitational-wave detector KAGRA with GEO 600", Progress of Theoretical and Experimental Physics **2022**, 063F01 (2022)

2. R. Abbott et al., *Search for gravitational-wave transients associated with magnetar bursts in Advanced LIGO and Advanced Virgo data from the third observing run*, 2022, arXiv:2210.10931 [astro-ph.HE]

1. R. Abbott et al., *Tests of General Relativity with GWTC-3*, 2021, arXiv:2112.06861 [gr-qc]

Research Experience

Pennsylvania State University, University Park, PA
Research Assistant, Department of Astronomy and Astrophysics

A Search for Extraterrestrial Laser Emissions 2022–Present
Advisor: Jason T. Wright

- Analyze near-infrared 1D stellar spectra taken with the Hobby-Eberly Telescope
- Set statistical thresholds to discriminate possible extraterrestrial laser signal from noise
- Develop machine-learning algorithms to analyze 2D stellar image to find possible

Massachusetts Institute of Technology, Cambridge, MA
Research Assistant, MIT Kavli Institute for Astrophysics and Space Research

Analyzing DeepClean Performance with GstLAL 2022
Advisor: Erik Katsavounidis

- Analyzed the real-time machine-learning DeepClean algorithm on gravitational-wave detectors
- Ran a gravitational-wave analysis pipeline to determine the performance of the algorithm
- Quantified the earlier detections and warnings of compact binary mergers

Comparison of Gravitational-Wave Skymaps 2021–2022
Advisor: Erik Katsavounidis

- Compared skymaps generated by different low-latency algorithms with ones generated by Bayesian inference using LIGO-Virgo data
- Quantified and analyzed the relatedness of low-latency skymaps for real signals detected by LIGO-Virgo and for simulated gravitational-wave events
- Developed possible methods for identifying noise in signals using the relatedness of low-latency skymaps

Carleton College, Northfield, MN
Research Assistant, Department of Physics and Astronomy

Measuring the Speed of Gravitational Waves and Testing Lorentz Symmetry 2020–2022
Advisor: Jay Tasson

- Measure the speed of gravitational waves using LIGO Bayesian inference nested sampling algorithms and Markov Chain Monte Carlo (MCMC) methods with LIGO-Virgo data
- Compute the constraints of the coefficients for Lorentz Violation in the nonbirefringent, nondispersive limit using the measurements of the speed of gravitational waves
- Test Lorentz violation with respect to dispersion

Emission Line Survey of M33 Galaxy 2019–2020
Advisor: Cindy Blaha

- Created continuum-subtracted images to measure the ionized hydrogen regions in M33 galaxy
- Studied the star-forming regions of M33 by analyzing the hydrogen emission regions
- Developed and implemented IRAF codes to further identify the H-II, O-III, and S-II regions
- Compared these regions to understand M33's chemical composition, thus its possible age

Teaching Experience

Pennsylvania State University, University Park, PA
Co-instructor, Astro 476 Search for Extraterrestrial Intelligence Fall 2023
Teaching Assistant, Astro 420W Planets and Planetary System Formation Fall 2022

Carleton College, Northfield, MN
Lab Assistant & Grader, Astro 110 Introduction to Astronomy Winter 2021 & Winter 2022
Lab Assistant, Astro 113 Observational and Laboratory Astronomy Fall 2021
Grader, Physics 235 Electricity and Magnetism Spring 2021
Lab Assistant, Physics 228 Atomic and Nuclear Physics and Lab Fall 2020

Talks

Invited Seminar

CU Boulder Department of Astrophysical and Planetary Sciences Seminar 2024
When to Search for Transmissions from Earth-level Civilizations

Research

Penn State SETI Symposium, State College, PA 2025
Detecting Extraterrestrial Civilizations That Employ an Earth-level Deep Space Network

The 2024 Assembly of the Order of the Octopus 2024
A search strategy for intercepting electromagnetic transmissions from extraterrestrial civilizations with Earth-level technology

AAS 243rd Meeting SETI/Technosignatures Session 2024
A Search for Infrared Laser Emission with the Hobby-Eberly Telescope

Penn State Department of Astronomy & Astrophysics Lunch Talk 2023
A Search for Infrared Laser Emission with the Hobby-Eberly Telescope

LIGO-Virgo-KAGRA TestingGR Group Telecon 2022
Measuring GW Speed and Lorentz Violation with the First Three GW Catalogs

Summer MKI Undergraduate Research Forum, Massachusetts Institute of Technology 2021
Comparison of Skymaps from Multiple Gravitational-Wave Event-Finding Methods

LIGO-Virgo-KAGRA Compact Binary Coalescences Low-Latency Telecon 2021
Comparison of Skymaps from cWB, GstLAL, PyCBC, and LALInference from O3 Data/Alerts

Outreach

Astronomy on Tap, State College, PA 2024
How to Look for Extraterrestrial Civilization with Earth-level Technology

Poster Presentations

Penn State SETI Symposium, State College, PA 2023
A Search for Infrared Laser Emission with the Hobby-Eberly Telescope

Undergraduate Research and Internship Symposium, Carleton College 2021
Comparison of Skymaps from Multiple Gravitational-Wave Event-Finding Methods

Carleton College/St. Olaf College Physics Dept. Poster Session, Carleton College 2021
Comparison of Skymaps from Multiple Gravitational-Wave Event-Finding Methods

LIGO-Virgo-KAGRA Collaboration Meeting 2021
Comparison of Skymaps from cWB, GstLAL, PyCBC, and LALInference from O3 Data/Alerts

LIGO-Virgo-KAGRA Collaboration Meeting 2021
Measuring the Speed of Gravitational Waves and Testing Lorentz Symmetry with O3a Data

LIGO-Virgo-KAGRA Collaboration Meeting 2021
Tests of Lorentz Symmetry with Speed of Gravity Measurements

Undergraduate Mentorship

Pedro A. Gabriel, Penn State Department of Aerospace Engineering '26 2022
- Laser SETI, HPF telluric mask improvement

Service & Outreach

Member, NASA Study Analysis Group on Technosignatures Working Groups 1, 2, & 3 2024-2025

Member, Penn State SETI Symposium 2025 Science Organizing Committee 2024-2025

Member, Penn State SETI Symposium 2025 Local Organizing Committee 2024-2025

Member, SETI Institute SETI Forward Award Review Committee 2024

Conference Chair, The 2024 Assembly of the Order of the Octopus 2023-2024
- A conference for early-career SETI researchers at Green Bank Observatory
- Co-chair of LOC and SOC

Student Manager, Penn State Extraterrestrial Intelligence (PSETI) Center 2023–2024
- Manage weekly PSETI seminars and the PSETI Center website

Member, Penn State Astronomy Colloquia & Department Talks Committee 2023–Present
- Select and invite speakers for the weekly departmental colloquia and talks
- Organize lunches between the speakers and graduate students

Member, Penn State SETI Symposium 2023 Local Organizing Committee 2022-2023

Member, Penn State Astronomy Outreach Group 2022–Present
- Give planetarium shows, telescope tours, and astronomy talks to the general public

Member, Penn State Towards a More Inclusive Astronomy Working Group 2022–Present

Alumni Interviewer, Carleton College Admissions Office 2022–Present

Media Appearance

Avery Hurt, How the Kardashev Scale Could Help Us Find Life on Other Planets, Discover Magazine, 2024

Skills

- Programming: Python, LaTeX, Unix, Java, R, Julia
- Software: HEALPix, HTML, Mathematica, IRAF, OriginLab, SAOImage DS9, Stellarium, Voyager, Logger Pro, R Studio, Premier Pro, Photoshop, Zoom, Microsoft Office Products
- Languages: English, Mandarin