M. Yiwei Chai

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Education

PhD in Astronomy and Astrophysics — expected 2027
Johns Hopkins University, Baltimore, MD, USA

MA in Astronomy and Astrophysics — May 2024
Johns Hopkins University, Baltimore, MD, USA

BA in Physics (Honours), summa cum laude — May 2022
University of Pennsylvania, Philadelphia, PA, USA

Research

Transiting Exoplanet Atmosphere Science Yields with Roman — 2024–present
Johns Hopkins University
Advisor: Dr Néstor Espinoza (STScI)

- Developed end-to-end simulations to predict secondary eclipse and chromatic transit yields for *Roman's* Galactic Bulge Time Domain Survey from realistic exoplanetary atmosphere signals

Characterising Hot Sub-Neptune Atmospheres Around a Sun-Like Star — 2024–2026
Johns Hopkins University
Advisors: Dr Néstor Espinoza & Dr Brett Morris (STScI)

- Reduced NIRSpec BOTS G395H observations for two sub-Neptunes in the TOI-125 system;
- Derived orbital parameters and TTVs for the system using `juliet` global fit to TESS & JWST light curves and HARPS RVs;
- Characterised atmospheres of both planets with `POSEIDON` atmospheric retrievals

Dynamical Interaction in a Young Multi-Body Disk-Bearing System — 2023–2024
Johns Hopkins University
Advisor: Dr Christine Chen (STScI)

- Reduced and calibrated MIRI MRS data for η Tel debris disk–brown dwarf system
- Extracted new epoch of spectroscopy for η Tel disk, and produced new spatially-resolved images using high-contrast imaging techniques
- Measured new epoch of astrometry, derived orbit, and extracted first mid-IR spectra for brown dwarf companion
- Analysed dynamical interaction between debris disk and brown dwarf

JWST MIRI MRS Spectral Extraction Techniques for Debris Disks — Spring 2023
Johns Hopkins University
Advisor: Dr Christine Chen (STScI)

- Reduced and calibrated simultaneous MIRI Imager data; used data to calculate precise positional information for MIRI MRS β Pic observations
- Gained experience simulating extended sources using `MIRISIM`
- Reduced, calibrated, and extracted spectrum from MIRI MRS data of β Pic point source and extended debris disk

Quantifying Model Comparison with Calibrated Bayesian Evidences — Fall 2022

Johns Hopkins University
Advisor: Dr Néstor Espinoza (STScI)

- Computed Bayesian posterior odds ratios for toy model using `MultiNest`
- Investigated significance of Gaussian-shaped feature at 4.5-4.6μm in the WASP 39-b *JWST* spectra using Bayesian evidence calibration

Metamaterial Antenna Design for Radio Cosmology Summer 2022
University of Pennsylvania
Advisor: Prof. James Aguirre

- Created preliminary design for a metamaterial radio antenna to probe the CMB using Ansys HFSS

Improving APOGEE Radial Velocities Using Statistical Techniques 2021–2022
University of Pennsylvania (Senior Honours Thesis)
Advisor: Prof. Cullen Blake

- Used Markov-Chain Monte Carlo machine learning methods to reduce the average radial velocity scatter of measurements from the APOGEE `allVisit` catalogue

A GNU Radio SETI Pipeline for the Allen Telescope Array (ATA) Summer 2021
Berkeley SETI Research Center
Advisor: Dr Wael Farah (SETI Institute), Dr Steve Croft (UC Berkeley)

- Created Python GNU Radio data processing pipeline for technosignature searches with the ATA
- Developed `gr-turboseti` module to adapt `turboSETI` software for GNU Radio
- Wrote script to identify ATA observation times for potential target stars with known planetary companions orbiting within the habitable zone

Real-time Graphical Representations of TIM Pointing Sensor Data 2019–2021
University of Pennsylvania
Advisor: Prof. James Aguirre

- Built HDF5 database for `dirfile` format datasets from legacy balloon-telescope experiment, and analysed legacy gyroscope data using Python
- Conducted product research and acquisition of fibre-optic gyroscopes for balloon-telescope pointing sensor array
- Contributed to development of Python code for graphically representing real-time gyroscope output data through the InfluxDB UI
- Designed a printed circuit board with Autodesk EAGLE for mini radio telescope used to test pointing sensors
- Created Python and Arduino code to write real-time temperature sensor data from Arduino Uno into InfluxDB and Grafana

Publications

Y. Chai, N. Espinoza, R. F. Wilson, et al. 2026. Roman GBTDS Exoplanet Atmosphere Science Yields: Transits and Secondary Eclipses, in prep.

Y. Chai, N. Espinoza, C. Fisher, et al. 2026. *JWST* NIRSpec G395H Transmission Spectra of Two Hot Sub-Neptunes in the TOI-125 System, AJ, accepted.

Y. Chai, C. H. Chen, K. Worthen, et al. 2024. *JWST* MIRI MRS Observations of the Eta Telescopii Debris Disk and its Brown Dwarf Companion, ApJ, 976, 167.

C. H. Chen, C. X. Lu, K. Worthen, et al. incl. **Y. Chai**. 2024. MIRI MRS Observations of Beta Pictoris II. The Spectroscopic Case for a Recent Giant Collision, ApJ,

973, 139.

K. Worthen, C. H. Chen, D. R. Law, et al. incl. **Y. Chai**. 2024. MIRI MRS Observations of Beta Pictoris I. The Inner Dust, the Planet, and the Gas, ApJ, 964, 168.

Talks & Posters

"Comparative to Population-Level Atmospheres with *JWST* and *Roman*" 9/2026
Seminar, Carnegie EPL, Washington, DC, USA

"Population-Level Atmosphere Science Yields with *Roman*" 6/2026
Exoplanets 6, Porto, Portugal

"Comparative to Population-Level Atmospheres with *JWST* and *Roman*" 3/2026
Seminar, University of Southern Queensland, Toowoomba, Australia

"Exoplanet Atmosphere Science with *Roman*" 10/2025
TRExS F2F Meeting, The Ohio State University, Columbus, OH, USA

"Preparing for Transiting Exoplanet Atmosphere Studies with *Roman*" 7/2025
Sagan Summer Workshop: Silver Jubilee, Pasadena, CA, USA

"Preparing for Transiting Exoplanet Atmosphere Studies with *Roman*" 7/2025
ExoClimes VII, Montréal, Canada

"New Capabilities for Studying Planetary Systems with *JWST* and *Roman*" 7/2025
IREx Café, Université de Montréal, Montréal, Canada (invited)

"A New View of η Telescopii with *JWST* MIRI MRS" 3/2025
NCAD 8, Washington DC, USA

"Preparing for Transiting Exoplanet Atmosphere Studies with *Roman*" 1/2025
AAS 245 Meeting, National Harbor, MD, USA

"Preparing for Transiting Exoplanet Atmosphere Studies with *Roman*" 11/2024
ExoJamboree, Baltimore, MD, USA

"*JWST* MIRI MRS Observations of the η Telescopii Debris Disk and its Brown Dwarf Companion" 9/2024
AstroCoffee, Johns Hopkins University, Baltimore, MD, USA

"New Capabilities for Studying Planetary Systems with *JWST* and *Roman*" 7/2024
NEWTS Lab Meeting, University of New South Wales, Sydney, Australia

"A New View of η Telescopii with *JWST* MIRI MRS" 3/2024
Dust Devils Workshop, Tucson, AZ, USA

"Quantifying Model Comparisons for Exoplanet Atmospheres with Bayesian Evidence Calibration" 6/2023
ERES VIII Symposium, New Haven, CT, USA

"A GNU Radio SETI Pipeline for the Allen Telescope Array" 9/2021
GNU Radio Conference, Charlotte, NC, USA

"The Use of Fibre-Optic Gyroscopes for the TIM Pointing Sensor Array" 8/2020

Penn GRAD Summer Academy Symposium, virtual

Awards & Grants

SETI Forward Award ($1500)	2021
Breakthrough Listen Travel Grant ($1100)	2021
Breakthrough Listen Summer REU Grant ($8364)	2021

Skills

Programming languages: Python, Mathematica, HTML
Software: Git, LaTeX, Ansys HFSS, GNU Radio, Grafana, InfluxDB
Other: Bash, statistics, machine learning

Teaching Experience

Introduction to Astrophysics II, Prof. Ravi Sheth	Spring 2022
Physics, Energy, & Global Warming, Prof. Douglas Durian	Fall 2021
Physics, Energy, & Global Warming, Prof. Gary Bernstein	Spring 2021

Outreach and Service

Mentor, Letters to a Pre-Scientist Program	2025–Present
CDI Representative, Physics and Astronomy Graduate Student Board	2025–2026
LOC Member, Gender Minorities and Women in Physics Summit	2024–2025
Mentor, Physics and Astronomy Mentorship Program	2023–2026
Observatory Assistant, Maryland Space Grant Observatory	2022–2023