M. Yiwei Chai

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Education

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

MA in Physics — 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 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.

Atmospheric Characterisation of 2 Sub-Neptunes in 1 System — 2024–present
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
- Ran global fit combining TESS & JWST light curves with HARPS RVs to obtain orbital parameters for the system using `juliet`
- Ran `POSEIDON` atmospheric retrievals to characterise the atmospheres of both planets

JWST MIRI MRS Observations of η Telescopii — 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
Advised by 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, 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

"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, NSW, 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	10/2025–Present
	CDI Representative, Physics and Astronomy Graduate Student Board	8/2025–Present
	LOC Member, Gender Minorities and Women in Physics Summit	2024–Present
	Mentor, Physics and Astronomy Mentorship Program	9/2023–Present
	Observatory Assistant, Maryland Space Grant Observatory	9/2022–5/2023