

# Chi Han

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## EDUCATION

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- University of Michigan - Ann Arbor (2020-2024, overall GPA: 3.803)
  - B.S. Honors Physics (major GPA: 3.920)
  - B.S. Honors Astronomy and Astrophysics (major GPA: 3.754)
  - B.S. Mathematical Physics (major GPA: 3.725)

## RESEARCH INTERESTS

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I am broadly interested in topics within cosmology and stellar astrophysics, and I enjoy applying computational methods to my studies. During my PhD, I hope to work with data from surveys, contribute to simulation projects, and bridge the gap between them. I employ various statistical tools in my study, including techniques in Bayesian inference and machine learning.

In cosmology, I aim to delve into the study of structure formation and the expansion of the universe, as well as explore the physics of various dark matter models. In stellar astrophysics, I hope to focus on dynamics in many-body systems and study stellar rotation through simulations. Additionally, I am interested in various astronomical imaging techniques.

## RESEARCH EXPERIENCE

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- **Anisotropic Distribution of Subhaloes: Coherent Accretion and Internal Orbits (SU 2023 - )**  
Instructors: Prof. Camille Avestruz, Dr. Kuan Wang
  - Processed data from IllustrisTNG Simulation to study the orbit of subhalos before and after their accretion.
  - Verified the coherent accretion of subhalos from cosmic filaments using spherical KDE.
  - Clustered subhalo orbits after accretion using machine learning methods to unveil the relation between orbit modes and subhalo properties.
- **Isochrone Fitting Model for Binary Systems in the ARMADA Survey (FA 2022 - )**  
Instructors: Prof. John Monnier, Dr. Tyler Gardner
  - Used the Python package `isochrones` to construct an isochrone fitting model and pipeline for approximately 70 targets in the ARMADA survey.
  - Applied MCMC techniques to investigate the correlations between parameters used for fitting.
  - Used the HD6456 system for a detailed study and discovered degeneracy caused by varying metallicity.
  - Inspected the distribution of the difference between photometric and dynamic masses of binary systems consisting of rapidly rotating A-stars using isochrone fitting.
  - The study potentially leads to methods for rotation correction in isochrone fitting.
- **Constructing the Metallicity Map of the Milky Way based on Open Cluster Orbits (SU 2023 - )**  
Instructors: Prof. John Monnier, Dr. Tyler Gardner
  - Applied machine learning techniques to make a metallicity map of the Milky Way with open cluster orbit. Used GALPY to obtain the birth position of over 1000 open clusters in the Gaia catalog.
  - Cross-checked with existing studies on Milky Way metallicity to verify the metallicity predicted with the machine learning algorithm.
- **Instrumentation work on infrared camera shutter and accelerometer (SU 2022)**  
Instructor: Prof. John Monnier

- Developed python and arduino script to read in accelerometer data, communicate with a raspberry pi, and analyze it through fourier transforms.
- Developed C scripts to control the shutter of infrared cameras on MIRC-X.
- **Late Time Swift Observations of the Relativistic TDE Candidate AT2022cmc (WN 2022)**  
Instructors: Prof. Jon Miller, Dr. Mark Reynolds
  - Used NASA's HEASARC Xspec to process optical, spectral, and time series data from the Swift Observatory.
  - **Han, C.**, Reynolds, M. T., Miller, J. M., Gediman B., Hemrattaphan Y., Zak, M. K. (2022)  
LATE TIME SWIFT OBSERVATIONS OF THE RELATIVISTIC TDE CANDIDATE AT2022CMC  
*Astronomers Telegram, 15439*

## PUBLICATIONS

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- **Han, C.**, Wang, K., Avestruz, C.  
ANISOTROPIC DISTRIBUTION OF SUBHALOES: COHERENT ACCRETION AND INTERNAL ORBITS  
Manuscript in preparation.  
\* anticipated submission in November, 2023

## POSTER AND TALKS

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- **Han, C.**, Gardner, T. Monnier, J.D., Peterson, C. (2023, April 14).  
THE ARMADA SURVEY: PHOTOMETRIC MASS AND AGE FOR INTERMEDIATE MASS BINARY SYSTEMS.  
[Poster Presentation]  
2023 Astronomy Undergraduate Poster Session, University of Michigan.
- **Han, C.** (2023, November 6).  
SUBHALO ORBITS AFTER ACCRETION: CLUSTERING WITH MACHINE LEARNING AND VISULIZATION  
[Talk]  
ALCCA Group Meeting, University of Michigan.
- **Han, C.**, Wang, K., Avestruz, C.  
ANISOTROPIC DISTRIBUTION OF SUBHALOES: COHERENT ACCRETION AND INTERNAL ORBITS  
Poster in preparation.  
243<sup>rd</sup> AAS Meeting, New Orleans, Louisiana.

## TEACHING AND OUTREACH

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- Telescope Operator (2022 - )
  - Operate the 0.4m Cassegrain Reflector at Angell Hall for public events and introductory astronomy classes.
- Contributed  $\LaTeX$  [Lecture Note](#) for Future Teaching - Physics 406 (Statistical Mechanics, WN 2023)
- Learning Assistant - Physics 104 (Programming for Introductory Science Courses, FA 2023)
  - Participate in lectures and hold office hours to answer questions on scientific programming with python.
- Member of Student Astronomical Society at University of Michigan (2021 - )

## SKILLS

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- Coding Languages:
  - Proficient: Python (scikit-learn, scipy, emcee, pytorch, lmfit, isochrones, illustris\_python), MATLAB
  - Intermediate: JAVA, C/C++
- Spoken Languages: Mandarin Chinese (Native), English (Proficient), Japanese, Bahasa Indonesia (Intermediate)

## RELEVANT ELECTIVE COURSEWORK

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- Astronomy: ASTRO 406 (Computational Astrophysics, A)
- Physics: PHYS 457<sup>†</sup> (Particle Physics and Cosmology); PHYS 526 (Cosmology, A); PHYS 535\* (General Relativity)
- Math: MATH 454 (Partial Differential Equation, A); MATH 556 (Applied Functional Analysis, A); MATH 572<sup>†</sup> (Numerical Differential Equation)

\* in progress, <sup>†</sup> will take next semester