

# Sihao Cheng (程思浩)

## Curriculum Vitae / Dec, 2025

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[google scholar page](#)

### POSITIONS

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Senior fellow	<i>Perimeter Institute &amp;</i>	
Member	<i>Institute for Advanced Study</i>	2022–present
Postdoc fellow	<i>Johns Hopkins University &amp;</i>	
Visiting fellow	<i>Centre of Data Science, École Normale Supérieure</i>	2021–2022

### EDUCATION

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Ph.D. & M.A., Astronomy and Astrophysics, <i>Johns Hopkins University</i>	2017–2021
Thesis title: Cosmology and Astrophysics with the Scattering Transform	
advisor: Brice Ménard	

  

B.Sc. (with Honors), Astronomy, <i>Peking University</i>	2012–2016
advisor: Eric W. Peng	

### RESEARCH INTEREST

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I use innovative and interdisciplinary ideas to make discoveries from “big data” and then develop physical understanding to them. My work has led to:

1. cosmological applications of a deep learning-inspired new statistic;
2. discovery of freezing stars powered by gravitational energy;
3. new window to study planets around massive stars;
4. discovery of a dwarf planet with the widest orbit in the Solar System.

I am also mapping the phase space of Milky Way’s disk with unprecedented clarity.

### AWARDS

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Outstanding Publication in Astrostatistics Award	2020
Wu-Si Scholarships and Lin-Qiao Prize for undergrads at Peking University	2014 – 2015
Gold Medals of international astronomical olympiads ( <a href="#">IOAA</a> , <a href="#">IAO</a> , & <a href="#">APAO</a> )	2008 – 2011

### GRANT & TELESCOPE TIME

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PI of <i>JWST</i> Cycle 3 program GO 6410, with USD \$60k	2025-2026
6 nights on 3.5m APO telescope	2019-2020

## MENTORING, TEACHING, & SERVICE

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undergrad student: Vedant Chandra (JHU -> Harvard)	2019–2020
grad student: Mesut Caliskan, Neha A. Kumar (JHU)	2024–
Teaching assistant, JHU, Stars & the Universe, Physics I & II	2017–2019
Referee for <i>ApJ, MNRAS, A&amp;A, Applied and Computational Harmonic Analysis</i>	
Organizing astrophysics seminar at IAS	2023–2024

## REFERENCES

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Prof. Brice Ménard	Johns Hopkins University	menard@jhu.edu
Prof. Scott Tremaine	Institute for Advanced Study	tremaine@ias.edu
Prof. Matias Zaldarriaga	Institute for Advanced Study	matiasz@ias.edu
Prof. Bhuvnesh Jain	University of Pennsylvania	bjain@physics.upenn.edu
Assoc. Prof. Yuan-Sen Ting	Ohio State University	ting.74@osu.edu

## TALKS & PRESENTATIONS

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Talk, <i>International Conference on Exoplanets and Planet Formation</i> , Shanghai	Dec 2025
Talk & Special announcement, <i>Annual Meeting of DDA</i> , Atlanta	May 2025
Talk, <i>Inter+Stellar</i> , STScI, Baltimore	May 2025
Talk, <i>COSMO'24</i> , Kyoto	Oct 2024
Talk, <i>Cosmology in the Adriatic - From PT to AI</i> , Split	July 2024
<b>Invited Talk</b> , <i>TDLI Astrophysics Forum</i> , Shanghai	July 2024
Talk, <i>Exoplanets 5</i> , Leiden	Jun 2024
<b>Invited Talk</b> , <i>Statistical Challenges in 21st Century Cosmology</i> , Chania	May 2024
Talk, <i>Extreme Solar System V</i> , Christchurch	Mar 2024
Talk, <i>Lensing at different scales</i> , University of Chicago	Aug 2023
Talk, <i>Future Science with CMB x LSS</i> , YITP, Kyoto	Apr 2023
Talk, <i>Exoplanet Systems and Stellar Life Cycles</i> , Aspen Center for Physics	Mar 2023
Talk, <i>White Dwarfs from Physics to Astrophysics</i> , KITP	Nov 2022
<b>Invited Talk</b> , <i>TianQin Astro Workshop</i> ,	Aug 2022
Talk, <i>European white dwarf workshop</i> , Tübingen	Aug 2022
Talk, <i>Kymatio'22</i> , Nantes	May 2022
Talk, <i>Cosmology with Weak Lensing: Beyond the Two-point Statistics</i> , YITP, Kyoto	Apr 2022
Talk, <i>Debating the potential of machine learning in astronomical surveys</i> , IAP, Paris	Oct 2021
Talk, <i>Learn the Universe – an ML x Cosmology Workshop</i> , CCA	Aug 2021
<b>Invited Talk</b> , <i>White Dwarfs from Physics to Astrophysics</i> , KITP	Mar 2021
Talk, <i>Cosmology from Home</i>	Aug 2020
Talk, <i>IAU Symposium No.357 on White Dwarfs</i> , Hilo, Hawaii	Oct 2019
Talk, <i>The Beginnings and Ends of Double White Dwarfs</i> , Copenhagen	July 2019
Poster, <i>Statistical Challenges in Modern Astronomy VII</i> ,	Jun 2021
Poster, <i>Where the Earth Meets the Sky</i>	May 2021
Poster, 2019 Spring Symposium: <i>The Deaths and Afterlives of Stars</i> , STScI	Apr 2019

Seminar at National Astronomical Observatory of Japan	Dec 2025
Seminar at IPMU, University of Tokyo	Dec 2025
Seminar at University of Kentucky	Oct 2025
Thunch talk at Princeton University	Apr 2025
ET Science Seminar at Shanghai Observatory	Apr 2025
Colloquium at Johns Hopkins University	Mar 2025
Colloquium at Stanford University	Jan 2025
Colloquium at Westlake University	Jan 2025
Colloquium at Peking University	Jan 2025
Colloquium at Tsinghua University	Jan 2025
Seminar at University of Chicago	Dec 2024
Seminar at University of Florida	Dec 2024
Seminar at Columbia University	Sept 2024
OPINAS seminar at MPE, Munich	July 2024
Cosmology seminar at University of Pennsylvania	May 2024
Seminar at Peking University	Dec 2023
Seminar at Tsinghua University	Dec 2023
Cosmology seminar at University of Pennsylvania	May 2023
Theoretical astrophysics seminar at Caltech	May 2023
Astrocoffee talk at Carnegie Observatories	May 2023
Seminar at University of California, Los Angeles	May 2023
Cosmology seminar at Stanford University, Stanford	May 2023
Cosmology seminar at Yale University	Mar 2023
Bahcall lunch talk at Princeton University	Feb 2023
Seminar at IAS, Princeton	Feb 2023
Thunch talk at Princeton University	Dec 2022
Euclid flash talk	Nov 2022
Astrolunch seminar at University of California, Santa Barbara	Nov 2022
Seminar at University of California, Santa Cruz	Nov 2022
Cosmology journal club at University of California, Berkeley	Nov 2022
Astrolunch seminar at LPENS, Paris	Jun 2022
Cosmology seminar at ETH, Zurich	Jun 2022
Cosmology seminar at Ludwig Maximilian University, Munich	Apr 2022
Seminar at Northwestern University	Apr 2022
Astro Machine Learning session at Tsinghua University	Mar 2022
Thunch seminar at Princeton University	Mar 2022
Cosmology seminar at MPA, Munich	Mar 2022
ICAP seminar, Paris	Jan 2022
Cosmology group meeting at Perimeter Institute	Dec 2021
Seminar at CEA Paris-Saclay	Dec 2021
Cosmology journal club at Harvard	Nov 2021
Data Science Seminar at École Normale Supérieure, Paris	Nov 2021
Cosmology seminar at University of California, Berkeley	Sept 2021
HotSci Seminar at STScI,	July 2021
Cosmology group meeting at Ohio State University	July 2021

Science coffee at STScI	July 2021
LSST DESC telecon	Jun 2021
Seminar at the German Center for Cosmological Lensing	May 2021
Cosmology group meeting at University of Edinburgh	May 2021
Seminar at Shanghai Jiao Tong University	Apr 2021
Cosmology group meeting at CfA	Mar 2021
Lunch talk at Peking University	Mar 2021
Seminar at Tsinghua University	Mar 2021
Colloquium (with Brice Meñard) at University of British Columbia	Mar 2021
Cosmology group meeting at Leiden	Jan 2021
Cosmology seminar at IPMU	Jan 2021
Cosmology seminar at IAP	Dec 2020
Lunch talk at University of Virginia/NRAO	Nov 2020
Euclid US telecon	Nov 2020
Cosmology/machine learning journal club at Fermilab	Oct 2020
Seminar at DIRAC, University of Washington	Oct 2020
Cosmology seminar at Duke University	Oct 2020
Seminar at Columbia University	Oct 2020
Astrophysics and Cosmology Seminar at University of Arizona	Sep 2020
Wine & Cheese seminar at Johns Hopkins University	Sep 2020
Cosmology journal club at University of Oxford	Sep 2020
<i>Euclid</i> Modelling working group	Sep 2020
Astrocoffee at Weizmann Institute of Science	Aug 2020
LSST DESC weak lensing mass mapping working group	Aug 2020
Astrophysics/Cosmology Seminar at University of Sussex	July 2020
Compact object journal club, STScI	Apr 2020
Lunch Seminar at Indiana University, Bloomington, IN	Mar 2020
CTC seminar at University of Maryland, College Park, MD	Mar 2020
Thunch seminar at Princeton University and astro-coffee at IAS, Princeton, NJ	Feb 2020
Seminar at Boston University, Boston, MA	Feb 2020
The Stars & Planets Seminar at CfA, Cambridge, MA	Feb 2020

## PUBLICATIONS

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(updated on Dec 31, 2025)

First-author and essential-contribution papers (4 are highlighted by \*):

\*11. [Discovery of a dwarf planet candidate in an extremely wide orbit: 2017 OF201](#)

(3 citations)

**Sihao Cheng**, Jiaxuan Li, and Eritas Yang

2025, arxiv:2505.15806, submitted to *ApJL*

\*10. [A Candidate Giant Planet Companion to the Massive, Young White Dwarf GALEX J071816.4+373139 Informs the Occurrence of Giant Planets Orbiting B Stars](#)

Opened a new window to probe planets around massive stars, which have been extremely difficult to find (6 citations)

**Sihao Cheng**, Kevin C. Schlaufman, and Ilaria Caiazzo

2024, *AJ*, 170, 47

**9. Cosmological constraints from weak lensing scattering transform using HSC Y1 data (17 citations)**

Applied the scattering transform to weak lensing data for the first time, and showed evidence of photo-z issue in HSC

**Sihao Cheng** et al.

2025, *JCAP*, 01, 006

**8. Scattering spectra for physics (15 citations)**

Built generative models for a variety of physical fields based on a small set of statistics

**Sihao Cheng**, Rudy Morel, Erwan Allys, Brice Ménard, and Stéphane Mallat

2024, *PNAS Nexus*, 3, Issue 4, 103

**7. Buoyant crystals halt the cooling of white dwarf stars (36 citations)**

Antoine Bédard, Simon Blouin, and **Sihao Cheng**

Explained the 10-Gyr cooling delay I discovered in 2019 by buoyant-crystal driven convective. I designed the project and heavily contributed to the writing

2024, *Nature*, 627, 286

**6. How to quantify fields and textures? A guide to the scattering transform (48 citations)**

Introduced the scattering transform in a non-technical way and showed new interesting interpretations of this estimator

**Sihao Cheng** and Brice Ménard

2021, arXiv:2112.01288

**5. Weak lensing scattering transform: dark energy and neutrino mass sensitivity (60 citations)**

Visualised what the statistics see from a lensing map, and emphasised the importance of statistical robustness of estimators

**Sihao Cheng** and Brice Ménard

2021, *MNRAS*, 507, 1012

**\*4. A new approach to observational cosmology using the scattering transform (141 citations)**

Introduced to observational cosmology a new statistic inspired by Convolutional Neural Nets, and demonstrated that it has CNN-level performance

**Sihao Cheng**, Yuan-Sen Ting, Brice Ménard, and Joan Bruna

2020, *MNRAS*, 499, 5902

**3. Double White Dwarf Merger Products among High-mass White Dwarfs (71 citations)**

Measured the white dwarf merger rate with unprecedented high precision using a novel kinematic method

**Sihao Cheng**, Jeffrey D. Cummings, Brice Ménard, and Silvia Toonen

2020, *ApJ*, 891, 160

**\*2. A Cooling Anomaly of High-mass White Dwarfs (125 citations)**

Discovered a special type of stars that shine out of gravitational sedimentation using Gaia data

**Sihao Cheng**, Jeffrey D. Cummings, and Brice Ménard

2019, *ApJ*, 886, 100

1. Meteor spectral observation with DSLR, normal lens and prism (3 citations)

**Sihao Cheng** and Simiao Cheng

2011, *JIMO*, 39, 39

Contributing-author papers:

15. First Constraints from Marked Angular Power Spectra with Subaru Hyper Suprime-Cam Survey First-Year Data

Cowell, J. A., **et al.**

2025, arxiv2507.12315

14. A Fog Over the Cosmological SGWB: Unresolved Massive Black Hole Binaries in the LISA Band

Mesut Çalışkan, Neha A. Kumar, Marc Kamionkowski, and **Sihao Cheng**

2025, arxiv2506.18965

13. Cosmology from HSC Y1 Weak Lensing with Combined Higher-Order Statistics and Simulation-based Inference (21 citations)

Novaes, C., **et al.**

2025, *PRD*, 111, 083510

12. Impact of baryonic feedback on HSC Y1 weak lensing non-Gaussian statistics (13 citations)

Grandón, D., **et al.**

2024, *PRD*, 110, 103539

11. A new code for low-resolution spectral identification of white dwarf binary candidates

Liu, G., **et al.**

2024, *A&A*, 690, A29

10. Dynamical masses across the Hertzsprung-Russell diagram (6 citations)

Hsiang-Chih Hwang, Yuan-Sen Ting, **Sihao Cheng**, and Joshua Speagle

2023, *MNRAS*, 528, 4272

9. Cosmology from weak lensing peaks and minima with Subaru Hyper Suprime-Cam survey first-year data (40 citations)

Marques, G. A., **et al.**

2023, *MNRAS*, 528, 4513

8. A Systematic Search for Short-period Close White Dwarf Binary Candidates Based on Gaia EDR3 Catalog and Zwicky Transient Facility Data (30 citations)

Ren, L., **et al.**

2023, *ApJS*, 264, 39

7. Euclid preparation-XXVIII. Forecasts for ten different higher-order weak lensing statistics (68 citations)

Euclid Collaboration, **et al.**

2023, *A&A*, 675, A120

6. Potential scientific synergies in weak lensing studies between the CSST and Euclid space probes (21 citations)

Liu, D. Z., **et al.**

2022, *A&A*, 669, A128

5. Forever young white dwarfs: when stellar ageing stops (50 citations)

Camisassa, M. **et al.**

I interpreted the simulation results

2021, *A&A Letters*, 649, 7

4. An Increase in Small-planet Occurrence with Metallicity for Late-type Dwarf Stars in the Kepler Field and Its Implications for Planet Formation (26 citations)

Cicero X. Lu, Kevin C. Schlaufman, and **Sihao Cheng**

I participated in the statistical analysis and writing

2020, *ApJ*, 160, 253

3. Multi-Gigayear White Dwarf Cooling Delays from Clustering-Enhanced Gravitational Sedimentation (70 citations)

Evan B. Bauer, Josiah Schwab, Lars Bildsten, and **Sihao Cheng**

We together developed the idea, and I interpreted the simulation result

2020, *ApJ*, 902, 93

2. A Gravitational Redshift Measurement of the White Dwarf Mass–Radius Relation (31 citations)

Vedant Chandra, Hsiang-Chih Hwang, Nadia L. Zakamska, and **Sihao Cheng**

I proposed and conducted the debias process and wrote part of the paper

2020, *ApJ*, 899, 146

1. Carbon star formation as seen through the non-monotonic initial–final mass relation (70 citations)

Marigo, P. **et al.**

I conducted the conversion between white dwarfs photometry and physical parameters

2020, *Nature Astronomy*

Conference proceeding:

Two delays in white dwarf evolution revealed by *Gaia* (3 citations)

**Sihao Cheng**

2019, *Proceedings of IAU*, 15 (S357), 175

Software:

`scattering_transform`

`WD_models`