Matthias Yang He, PhD

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Positions

Postdoctoral Research Associate – University of Notre Dame — **Notre Dame**
Department of Physics and Astronomy — *2022–Present*
Advisor: Prof. Lauren M. Weiss

Education

PhD in Astronomy & Astrophysics – Pennsylvania State University — **University Park**
with Computational Science Graduate Minor — *2016–2022*
Advisor: Prof. Eric B. Ford

Honours BSc – University of Toronto — **St. George**
Astronomy & Physics Specialist, with High Distinction — *2012–2016*
Advisor: Prof. Dae-Sik Moon

Work Experience

Scientific Code Reviewer, Department of Astronomy & Astrophysics, Penn State	2022
Graduate Teaching Assistant, Dept. of Astronomy & Astrophysics, Penn State	2021
Graduate Research Assistant, Dept. of Astronomy & Astrophysics, Penn State	2017 – 2022
Research Assistant, Canadian Institute for Theoretical Astrophysics (CITA)	2016
Research Assistant, Dept. of Astronomy & Astrophysics, UofT	2015 – 2016

Awards and Fellowships

NASA Exoplanets Research Program (XRP) Grant, Co-I (PI Lauren Weiss) – $556K	2023 – 2026
NSERC Postgraduate Scholarship - Doctoral (PGS D) Award – CAD $63K	2018 – 2021
NASA ExoPAG Travel Grant	2019
AAS International Travel Grant (ITG)	2019
Zaccheus Daniel Fellowship	2019
TESS Science Conference I registration	2019
Center for Exoplanets and Habitable Worlds (CEHW) Small Grant	2019
The Royal Astronomical Society of Canada Gold Medal	2016
University Graduate Fellowship – $27.5K	2016
NSERC Summer Undergraduate Research Program Award	2016
University of Toronto Dean's List	2012 – 2016
Woodsworth College Scholarship	2014
John Pounder Scholarship in Astronomy & Astrophysics	2014
Donald MacRae Scholarship in Astronomy & Astrophysics	2013
University of Toronto President's Scholar	2012
Governor General Academic Medal	2012

Conference and Research Talks

Great Lakes Exoplanet Area Meeting (GLEAM)	Ohio State – Nov 18, 2022
Penn State Dissertation Defense	Virtual – Feb 15, 2022
Center for Space and Habitability (CSH) Fellowship Talk	Virtual – Feb 2, 2022
Bay Area Exoplanet Meeting (BAEM) 39	Virtual – Dec 3, 2021
UChicago Exoplanet Journal Club (invited)	Virtual – Oct 10, 2021
Chesapeake Bay Area Exoplanet (CHEXO) Meeting	Virtual – May 14, 2021
PLATO ESP 2020	Virtual – Dec 3, 2020
Exoplanet Demographics (ExoDem 2020)	Virtual – Nov 11, 2020
Birmingham Group Meeting (invited)	Virtual – Oct 26, 2020
Europlanet Science Congress (EPSC 2020)	Virtual – Sep 24, 2020
Center for Exoplanets and Habitable Worlds (CEHW) Seminar	Virtual – Sep 14, 2020
Iowa State Journal Club (invited)	Virtual – Aug 17, 2020
Division on Dynamical Astronomy (DDA) 51st Annual Meeting	Virtual – Aug 3, 2020
Exoplanets III (EXO3) – Plenary	Virtual – Jul 29, 2020
Chesapeake Bay Area Exoplanet (CHEXO) Meeting	Virtual – Jun 26, 2020
NASA ExoPAG 21 (speaker + panelist)	Honolulu, HI – Jan 4, 2020
Lunch Talk, Dept. of Astronomy & Astrophysics	Penn State – Sep 17, 2019
Extreme Solar Systems IV (ExSS4)	Reykjavík, Iceland – Aug 20, 2019
Stars and Planets Seminar	CITA/UofT – Jul 19, 2019
ERES V	Cornell – Jun 17, 2019
SMAC Talk, Dept. of Statistics	Penn State – Mar 22, 2019
ERES IV	Penn State – Jun 22, 2018
Lunch Talk, Dept. of Astronomy & Astrophysics	Penn State – Jan 16, 2018
ERES III	Yale – Jun 13, 2017

Conference Posters

Protostars & Planets VII	Kyoto, Japan – Apr 10–15, 2023
COSE-JAM	Notre Dame – Dec 9, 2022
ERES VII	Penn State – Aug 1–2, 2022
DDA 53rd Annual Meeting	Flatiron Institute – Apr 25–28, 2022
TESS Science Conference II	Virtual – Aug 2–6, 2021
Statistical Challenges in Modern Astronomy (SCMA) VII	Virtual – Jun 7–10, 2021
ERES 2021	Virtual – May 24–26, 2021
AAS Meeting #236	Virtual – Jun 1–3, 2020
TESS Science Conference I	MIT – Jul 29–Aug 2, 2019
Institute for Computational Science (ICS) Symposium	Penn State – Apr 1, 2019
SAMSI ASTRO Transition Workshop	Durham, NC – May 9, 2017

Mentoring

Matthew Doty (undergraduate) – Research Project & Summer REU, Notre Dame	2023 – Present
Shibo Yu (undergraduate) – Physics Mentorship Program, UofT	2022 – 2023
Ryan Wang (undergraduate) – Physics Mentorship Program, UofT	2021 – 2022

Lukas Kerge (high school student) – Research Science Institute, MIT 2020
Ashutosh Banjara (undergraduate) – Physics Mentorship Program, UofT 2019 – 2020

Service and Outreach

Scientific Organizing Committee – Great Lakes Exoplanet Area Meeting (GLEAM) 2022
Referee – The American Astronomical Society (AAS) Journals 2021 – Present
Co-organizer – Emerging Researchers in Exoplanet Science (ERES) VII, Penn State 2021 – 2022
Teaching assistant – Summer School in Astrostatistics & Astroinformatics XVII, Penn State 2022
Co-organizer – Center for Exoplanets and Habitable Worlds Journal Club, Penn State 2020
Workshop lead – Penn State Inservice Workshops in Astronomy, Penn State 2017, 2018
Volunteer – AstroFest and AstroNight, Penn State 2017, 2018

Popular Press

"Can we predict if a system will have giant planets?" – Universe Today
"Astronomers develop model for the distribution of inner planetary systems" – Penn State ICDS News

Programming and Technical Skills

Advanced: Python, Julia, LaTeX, GitHub, Git, Keynote
Intermediate: C++, ssh, Sphinx
Basic: R, DS9, bash

Publications

9 first-author refereed manucripts with 222 citations (ADS, as of Jul 1, 2023)

Refereed papers

Beyond 2-D Mass-Radius Relationships: A Nonparametric and Probabilistic Framework for Characterizing Planetary Samples in Higher Dimensions
Shubham Kanodia, **Matthias Y. He**, Eric B. Ford, Sujit K. Ghosh, Angie Wolfgang, submitted to AJ

Inner Planetary System Gap Complexity is a Predictor of Outer Giant Planets
Matthias Y. He, Lauren M. Weiss, 2023, AJ, 166, 36-48

Debiasing the Minimum-Mass Extrasolar Nebula: On the Diversity of Solid Disk Profiles
Matthias Y. He, Eric B. Ford, 2022, AJ, 164, 210-220

Developing a Drift Rate Distribution for Technosignature Searches of Exoplanets
Megan G. Li, Sofia Z. Sheikh, Christian Gilbertson, **Matthias Y. He**, Howard Isaacson, Steve Croft, Evan L. Sneed, submitted to AJ

Edge-of-the-Multis: Evidence for a Transition in the Outer Architectures of Compact Multiplanet Systems
Sarah C. Millholland, **Matthias Y. He**, Jon K. Zink, 2022, AJ, 164, 72-87

Friends and Foes: Conditional Occurrence Rates of Exoplanet Companions and their Impact on Radial Velocity Follow-up Surveys

Matthias Y. He, Eric B. Ford, Darin Ragozzine, 2021b, AJ, 162, 216-238

Evidence for a Non-Dichotomous Solution to the Kepler Dichotomy: Mutual Inclinations of Kepler Planetary Systems from Transit Duration Variations

Sarah C. Millholland, **Matthias Y. He**, Eric B. Ford, Darin Ragozzine, Daniel Fabrycky, Joshua N. Winn, 2021, AJ, 162, 166-183

Architectures of Exoplanetary Systems. III: Eccentricity and Mutual Inclination Distributions of AMD-stable Planetary Systems

Matthias Y. He, Eric B. Ford, Darin Ragozzine, Daniel Carrera, 2020, AJ, 160, 276-314

Architectures of Exoplanetary Systems. II: An Increase in Inner Planetary System Occurrence Toward Later Spectral Types for Kepler's FGK Dwarfs

Matthias Y. He, Eric B. Ford, Darin Ragozzine, 2021a, AJ, 161, 16-40

Architectures of Exoplanetary Systems. I: A Clustered Forward Model for Exoplanetary Systems around Kepler's FGK Stars

Matthias Y. He, Eric B. Ford, Darin Ragozzine, 2019, MNRAS, 490, 4575-4605

On the stability and collisions in triple stellar systems

Matthias Y. He, Cristobal Petrovich, 2018, MNRAS, 474, 20-31

First limits on the occurrence rate of short-period planets orbiting brown dwarfs

Matthias Y. He, Amaury H.M.J. Triaud, Michaël Gillon, 2017, MNRAS, 464, 2687-2697

KMTNet Supernova Program Variable Objects I. NGC 2784 Field

Matthias Y. He, Dae-Sik Moon, Hilding Neilson, Jae-Joon Lee, Sang Chul Kim, Mina Pak, Hong Soo Park, Dong-Jin Kim, Yongseok Lee, Seung-Lee Kim, Chung-Uk Lee, 2016, JKAS, 49, 209-233

Conference proceedings

Supernova and optical transient observations using the three wide-field telescope array of the KMTNet

Dae-Sik Moon, Sang Chul Kim, Jae-Joon Lee, Mina Pak, Hong Soo Park, **Matthias Y. He**, John Antoniadis, Yuan Qi Ni, Chung-Uk Lee, Seung-Lee Kim, Byeong-Gon Park, Dong-Jin Kim, Sang-Mok Cha, Yongseok Lee, Santiago Gonzalez, 2016, Proc. SPIE 9906

Software

SysSimPyMMEN [GitHub] [ReadtheDocs] [PyPI] Python

Developers: Matthias Y. He

- Python package for inferring the minimum mass extrasolar nebula (MMEN) from the SysSim models
- Detailed documentation and tutorials on functions and usage
- Accompanies the publication He & Ford (2022)

SysSimPyPlots [GitHub] [ReadtheDocs] [PyPI] Python

Developers: Matthias Y. He

- Python package for loading, analyzing, and plotting catalogs generated from the SysSim models
- Detailed documentation and tutorials on functions and usage

- Used to generate the figures in 5 first author papers

SysSimExClusters [GitHub] Julia

Developers: Matthias Y. He, Eric B. Ford

- Julia package for simulating planet catalogs from the statistical models that are fit to the *Kepler* data
- Provides a branch for each of the "Architectures of Exoplanetary Systems" series papers (I, II, & III)
- Provides a branch for the He, Ford, & Ragozzine (2021b) paper
- Simulated catalogs have been directly used in 9 journal publications (5 first author, 2 second author, 2 by other authors)

ExoplanetsSysSim [GitHub] Julia

Developers: Eric B. Ford, Matthias Y. He, Danley Hsu, Darin Ragozzine

- Core *SysSim* code for simulating planetary systems and the Kepler detection pipeline
- Contributed to various elements to make it work with SysSimExClusters