Matthias Yang He

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hematthi • Ph.D. Candidate in Astronomy & Astrophysics

Education

Pennsylvania State University — **University Park**
Ph.D. in Astronomy & Astrophysics, with minor in Computational Science — *2016–2021 (expected)*
Advisor: Prof. Eric B. Ford

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

Research Experience

Architectures of the Kepler Exoplanetary Systems — **Penn State**
Graduate Research Assistant, Department of Astronomy & Astrophysics — *Summer 2017 – Present*
Supervisor: Prof. Eric B. Ford
- Worked on *ExoplanetsSysSim*, a code for generating simulated observed catalogs of exoplanets via the *Kepler* mission
- Developed a clustered model for generating exoplanetary systems to explain the observables of the *Kepler* exoplanet population, and to study their system architectures
- Coded a Gaussian Process emulator for approximating the model fits to the *Kepler* data

Stability of Triple Systems — **CITA/U of T**
Research Assistant, Canadian Institute for Theoretical Astrophysics (CITA) — *Summer 2016*
Supervisor: Dr. Cristobal Petrovich
- Performed N-body integrations on the CITA computing cluster using REBOUND code to study the stability of three-body systems
- Tested previous stability criteria and analyzed the dynamical evolution of bodies in terms of collisions, ejections, and stable systems

Korea Microlensing Telescope Network (KMTNet): Variable Objects — **U of T**
Research Assistant, Department of Astronomy & Astrophysics — *Summer 2015 – 2016*
Supervisor: Prof. Dae-Sik Moon
- Handled large amounts of photometric images and catalogs to match objects and obtain light curves
- Filtered through many sources to detect, analyze, and classify new variable objects

Occurrence Rates of Exoplanets around Brown Dwarfs — **U of T**
Research Assistant, Department of Astronomy & Astrophysics — *Summer 2015*
Supervisor: Dr. Amaury Triaud, Prof. Yanqin Wu
- Performed data reduction and differential photometry on data acquired from the Joan Oró Telescope
- Explored the detection of exoplanet transits in light curves using statistical methods
- Investigated the data presented in the Metchev et al. (2015) paper and performed numerical simulations of injection-and-retrieval tests of transit signals
- Computed limits on the occurrence rates of Earth-sized planets around brown dwarfs

Refereed Publications

Architectures of Exoplanetary Systems: Eccentricity and Mutual Inclination Distributions of AMD-Stable Planetary Systems

Matthias Y. He, Eric B. Ford, Darin Ragozzine, Daniel Carrera, submitted to AJ, arXiv:2007.14473

Architectures of Exoplanetary Systems. II: An Intrinsic Relation between Planetary System Occurrence and Spectral Type for Kepler's FGK Dwarfs

Matthias Y. He, Eric B. Ford, Darin Ragozzine, arXiv:2003.04348

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, 2017, MNRAS, 474, 20-31

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

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

Matthias Y. He, Amaury H.M.J. Triaud, Michaël Gillon, 2016, MNRAS, 464, 2687-2697

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

Awards and Distinctions

NSERC Postgraduate Scholarship - Doctoral (PGS D) Award
Doctoral scholarship – CAD $63,000 over 3 years *2018 – 2021*

The Royal Astronomical Society of Canada (RASC) Gold Medal
Top student graduating with a B.Sc. in Astronomy & Astrophysics *2016*

University Graduate Fellowship
Graduate program admission fellowship at Penn State – USD $27,500 *2016*

Clarence Augustus Chant Fellowship
Graduate program admission award at U of T – CAD $10,000 (declined) *2016*

NSERC Summer Undergraduate Research Program (SURP) Award
CAD $6,000 *2016*

University of Toronto Dean's List
All semesters *2012 – 2016*

Woodsworth College Scholarship
2014

John Pounder Scholarship in Astronomy & Astrophysics
Highest graded average between the two 2nd year core astrophysics courses *2014*

Donald MacRae Scholarship in Astronomy & Astrophysics
Highest GPA of Astronomy & Physics Specialist majors *2013*

University of Toronto President's Scholar
Top 50 of all admitted undergraduates – scholarship CAD $5,000 *2012*

Governor General Academic Medal
Highest GPA of graduating class in a Canadian high school *2012*

Grants

NASA ExoPAG Travel Grant
Full expenses paid ($3,000) to give a talk at the ExoPAG 21 conference in Honolulu, HI *2019*

Zaccheus Daniel Fellowship
Support for travel ($800) to Exoplanets III conference in Heidelberg, Germany *2019*

AAS International Travel Grant (ITG)
Support for travel ($500) to Extreme Solar Systems IV (ExSS4) conference in Reykjavík, Iceland *2019*

TESS Science Conference I
Registration fee ($330) *2019*

Center for Exoplanets and Habitable Worlds (CEHW) Small Grant
Support for travel ($800) to ExSS4 conference *2019*

Conference and Research Talks

Division on Dynamical Astronomy (DDA) – 51st Annual Meeting **Online**
The Intrinsic Architectures of Planetary Systems: *Aug 3, 2020*
Correlations in AMD-Stable Systems

Exoplanets III (EXO3) – Plenary **Online**
The Intrinsic Architectures of Planetary Systems: *Jul 29, 2020*
Correlations in Periods, Sizes, and Stellar Types

Chesapeake Bay Area Exoplanet (CHEXO) Meeting **Online**
The Intrinsic Architectures of Planetary Systems: *Jun 26, 2020*
Intra-system Correlations and Occurrence with Stellar Type

NASA ExoPAG 21 student speaker* **Honolulu, HI**
Forward Modeling the Architectures of Exoplanetary Systems: *Jan 4, 2020*
A Clustered Model using Kepler Data
*Also served on panel for discussion of Kepler reliability

Lunch Talk – Department of Astronomy & Astrophysics **Penn State**
Forward Modeling the Architectures of Exoplanetary Systems *Sep 17, 2019*

Extreme Solar Systems IV (ExSS4) **Reykjavík, Iceland**
The Intrinsic Distribution of Planetary Systems: *Aug 20, 2019*
Modeling the Impact of Clustering on Planetary Architectures

Stars and Planets Seminar **CITA/U of T**
Forward Modeling the Architectures of Exoplanetary Systems: *Jul 19, 2019*
A Clustered Model using Kepler Data

ERES V **Cornell**
Modeling the Architectures of Exoplanetary Systems: *Jun 17, 2019*
A Clustered Model using Kepler Data

SMAC Talk – Department of Statistics **Penn State**
Forward Modeling of the Kepler Exoplanetary Systems *Mar 22, 2019*

ERES IV — **Penn State**
Characterizing the Architectures of the Kepler Exoplanetary Systems — *Jun 22, 2018*

Lunch Talk – Department of Astronomy & Astrophysics — **Penn State**
Characterizing the Architectures of the Kepler Exoplanetary Systems — *Jan 16, 2018*

ERES III — **Yale**
Modeling Period and Period Ratio Distributions of Kepler Exoplanetary Systems — *Jun 13, 2017*

Summer Undergraduate Research Program (SURP) — **CITA/U of T**
Stability of Triple Systems — *Jul 7, 2016*

Conference Posters

AAS 236 — **Online**
The Intrinsic Architectures of Planetary Systems: — *June 1–3, 2020*
Inter- and Intra-system Correlations of Planets

TESS Science Conference I — **MIT**
Architectures of Exoplanetary Systems: — *Jul 29 – Aug 2, 2019*
A Forward Model for Planets around Kepler's FGK Stars with Clustered Periods and Sizes

ICS Symposium — **Penn State**
Characterizing the Architectures of the Kepler Exoplanetary Systems — *Apr 1, 2019*
with a Clustered Model

SAMSI ASTRO Transition Workshop — **Durham, North Carolina**
Modeling Period and Period Ratio Distributions of Exoplanetary Systems — *May 9, 2017*

Programming and Technical Skills

Advanced: Python, Julia, LaTeX, GitHub, Git

Intermediate: Keynote, ssh, C++

Basic: R, DS9, bash

Outreach Activities

AstroNight — **Penn State**
Volunteer — *Oct 12, 2019*

Penn State Inservice Workshops in Astronomy (PSIWA) — **Penn State**
Computers and the Universe — *Jul 17, 2018*
Gave a presentation about fractals to teachers of high-school and led a day-long workshop on computer generated fractals using my own code

AstroFest — **Penn State**
Volunteer — *Jul 11–14, 2018*

AstroFest — **Penn State**
Volunteer — *Jul 12–15, 2017*

Penn State Inservice Workshops in Astronomy (PSIWA) — **Penn State**
Computers and the Universe — *Jun 21, 2017*
Gave a presentation about fractals to teachers of high-school and led a day-long workshop on computer generated fractals using my own code

Mentoring

Lukas Kerge, high school student — **MIT**
Research Science Institute — *Jul 2020*

Ashutosh Banjara, 3rd year undergraduate **U of T**
Physics Mentorship Program *Sep 2019 – May 2020*

References

Dr. Eric B. Ford (PhD advisor): Professor of Astronomy & Astrophysics, Penn State University
Dr. Darin Ragozzine: Professor of Astronomy & Astrophysics, Brigham Young University
Dr. Rebekah (Bekki) Dawson: Assistant Professor of Astronomy & Astrophysics, Penn State University
Dr. Cristobal Petrovich: Canadian Institute for Theoretical Astrophysics
Dr. Dae-Sik Moon: Professor of Astronomy & Astrophysics, University of Toronto