# 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* — *2016–2022 (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. II: An Intrinsic Relation between Planetary System Occurrence and Spectral Type for Kepler's FGK Dwarfs

**Matthias Y. He**, Eric B. Ford, Darin Ragozzine, submitted to MNRAS, 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

**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

**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 with a Clustered Model* *Apr 1, 2019*
**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

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

## 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