
Dr. Eliot Halley Vrijmoet

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Research interests: ground- and space-based astrometric techniques (observing, data reduction, characterization of objects' motions); dynamics of stars, brown dwarfs, and planetary systems; fundamental properties of low-mass stars.

APPOINTMENTS

FCAD Research & Teaching Postdoctoral Fellow August 2023 – present
Smith College and the Five College Astronomy Dept., Northampton, MA

EDUCATION

Georgia State University, Atlanta, GA 2016 – 2023

Ph.D. Astronomy (August 2023)

Dissertation: *Orbital Architectures of M Dwarf Companions* ([click here for video of defense](#))

Advisor: Dr. Todd J. Henry

M.S. Physics (August 2020)

San Diego State University, San Diego, CA 2014 – 2016

Graduate coursework

Research Advisor: Dr. Jerome Orosz

Reed College, Portland, OR 2009 – 2013

B.A. Physics

Thesis: *Numerically Levitating Objects with Rockets*

Advisor: Dr. Joel Franklin

PUBLICATIONS & PAPERS

<https://orcid.org/0000-0002-1864-6120>

The Solar Neighborhood LI: A Variability Survey of Nearby M Dwarfs with Planets from Months to Decades with TESS and the CTIO/SMARTS 0.9 m

Kar, A., Henry, T. J., Couperus, A. C., **Vrijmoet, E. H.**, Jao, W.-C. 2024, [arXiv:2402.14121](#) (in press)

Enabling Exoplanet Demographics Studies with Standardized Exoplanet Survey Meta-Data (white paper)

SIG2 on Exoplanet Demographics: Christiansen, J., Bennett, D., Boss, A., [...], **Vrijmoet, E. H.** 2023 [arXiv:2304.05692](#)

A Seven-Day Multi-Wavelength Flare Campaign on AU Mic I: High-Time Resolution Light Curves and the Thermal Empirical Neupert Effect

Tristan, I. I., Notsu, Y., Kowalski, A. F., [...], **Vrijmoet, E. H.**, et al. 2023, *ApJ*, 951, 33

Estimating the Convective Turnover Time

Jao, W.-C., Couperus, A., **Vrijmoet, E. H.**, Wright, N., & Henry, T. J. 2022, *ApJ*, 940, 145

The Solar Neighborhood. XLIX. New Discoveries and Orbits of M Dwarf Multiples with Speckle Interferometry at SOAR

Vrijmoet, E. H., Tokovinin, A., Henry, T.J., Winters, J.G., Horch, E., & Jao, W.-C. 2022, *AJ*, 163, 178

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- The LHS 1678 System: Two Earth-Sized Transiting Planets and an Astrometric Companion Orbiting an M Dwarf Near the Convective Boundary at 20 pc*
Silverstein, M.L., Schlieder, J.E., Barclay, T., Hord, B.J., Jao, W.-C., **Vrijmoet, E. H.**, et al. 2021, *AJ*, **163**, 151
- The Solar Neighborhood. XLVI. Revealing New M Dwarf Binaries and their Orbital Architectures*
Vrijmoet, E. H., Henry, T. J., Jao, W.-C., and Dieterich, S. B. 2020, *AJ*, **160**, 215
- The First Habitable Zone Earth-sized Planet from TESS. I: Validation of the TOI-700 System*
Gilbert, E. A., Barclay, T., Schlieder, J. E., [...], **Vrijmoet, E. H.**, et al. 2020, *AJ*, **160**, 116
- Three Red Suns in the Sky: A Transiting, Terrestrial Planet in a Triple M Dwarf System at 6.9 Parsecs*
Winters, J. G., Medina, A. A., Irwin, J. M., [...] **Vrijmoet, E. H.**, et al. 2019, *AJ*, **158**, 152
- Filtered Monitoring of 1591 Baize*
Bentz, M. C., Abbott, C., Agudelo, S., [...], **Vrijmoet, E. H.**, Yep, A. 2018, *Minor Planet Bul.*, **45**, 311
- The Solar Neighborhood XLIV: RECONS Discoveries within 10 parsecs*
Henry, T. J., Jao, W.-C., Winters, J. G. W., [...], **Vrijmoet, E. H.** 2018, *AJ*, **155**, 265
- Kepler Eclipsing Binary Stars. VII. The Catalog of Eclipsing Binaries Found in the Entire Kepler Data Set*
Kirk, B., Conroy, K., Prša, A., [...] **Vrijmoet, E. H.**, et al. 2016, *AJ*, **151**, 68

TALKS

★ = invited talk

- ★ *Mapping Motions of the Most Nearby Stars — a Big-Picture View of their Dynamical Histories*
16 November 2023, Colloquium
Five College Astronomy Department (Amherst, MA)
- ★ *Orbital Architectures of M Dwarf Companions*
28 June 2023, Earth 2.0 Science Seminar Series
Shanghai Jiao Tong University, Tsung-Dao Lee Institute (virtual)
- ★ *One Big Picture of M Dwarf Binary Star Orbits*
7 March 2023, Colloquium
Troy Univ., Dept. of Chemistry and Physics (Troy, AL)
- Orbital Architectures of M Dwarf Companions*
11 January 2023, AAS Dissertation talk #321.05D
241st Meeting of the American Astronomical Society (Seattle, WA)
- ★ *One Big Picture of M Dwarf Binary Orbits*
13 September 2022, Seminar
Center for Astrophysics | Harvard & Smithsonian (Cambridge, MA)
- ★ *One Big Picture of M Dwarf Binary Orbits*
29 August 2022, Center for Exoplanets and Habitable Worlds (CEHW) Seminar Series
Pennsylvania State Univ., Dept. of Astronomy and Astrophysics (State College, PA)
- Little Stars with Little Friends: Observing Orbits of Our Nearest Neighbors*
29 July 2021, Summer Seminar Series
Georgia State Univ., Dept. of Physics and Astronomy (virtual)
- ★ *Revealing Orbital Architectures of M Dwarf Binaries with Long-term Astrometry and Speckle Interferometry*
16 October 2020, Carnegie Earth and Planets Laboratory (EPL) Astronomy Seminar Series
Carnegie Earth and Planets Laboratory (virtual)

- ★ *Adventures in Astrometry & Fun with Photometry: Characterizing Red Dwarfs in Pursuit of the Big Picture*
 16 October 2019, Special Seminar
 NASA Goddard Space Flight Center (Greenbelt, MD)
- LGBTQIA+ inclusion in astronomy: a status report*
 (presented by J. Rigby, with contributions by 20 coauthors including E. H. Vrijmoet)
 14 October 2019 at Inclusive Astronomy 2 (Space Telescope Science Institute, Baltimore, MD)
- ★ *RECONS and Gaia Astrometric Discoveries with Considerations for JWST*
 6 January 2019, Early Career Researcher Talk
 Exoplanet Analysis Group (ExoPAG) Meeting 19 (Seattle, WA)

POSTER PRESENTATIONS

AAS = American Astronomical Society

- M Dwarf Companions' Orbital Eccentricities Could Depend on Mass*
 25–29 July 2022, Poster #43, 2022 Sagan Summer Workshop (Pasadena, CA)
- Orbit Sizes & Shapes for M Dwarf Multiples: A Journey Through Astrometry, Speckle Interferometry, & More*
 6–8 July 2022, Poster #282, Cool Stars 21 (Toulouse, France)
- Orbits of M Dwarf Binaries Big and Small: Revealing their Shapes and Sizes via a Multi-Pronged Observing Campaign*
 14 June 2022, iPoster #205.10, 240th Meeting of the AAS (Pasadena, CA)
- Orbital Architectures of M Dwarf Systems*
 18 May 2021, [Poster #204.03](#), 52nd Meeting of the Division for Dynamical Astronomy (virtual)
- Orbital Architectures of M Dwarf Systems: Building the P vs. e Diagram*
 March 2021, [Poster](#), Cool Stars 20.5 (virtual)
- Orbital Architectures of M Dwarf Systems: Building the Mass-Luminosity Relation in the I-Band*
 15 January 2021, [iPoster-Plus \(talk\) #530.02](#), 237th Meeting of the AAS (virtual)
- Orbital Architectures of M Dwarfs with Stellar, Brown Dwarf, and Planetary Companions*
 January 2020, Poster #274.12, 235th Meeting of the AAS (Honolulu, HI)
- Orbital Architectures of Stellar, Brown Dwarf, and Planet Companions around Nearby M Dwarfs*
 January 2019, Poster #259.11, 233rd Meeting of the AAS (Seattle, WA)
- Statistics of Triple Star Systems in the Kepler Field*
 June 2016, Poster #218.10, 228th Meeting of the AAS (San Diego, CA)

GRANTS & AWARDS

\$9,600 total

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| Outstanding Senior Graduate Student Award
<i>Dept. of Physics and Astronomy, Georgia State Univ.</i> | April 2023
\$500 |
| Chambliss Astronomy Achievement Student Award, Honorable Mention
<i>240th Meeting of the American Astronomical Society</i> | July 2022 |
| Support for travel to the 2022 Sagan Summer Sessions Workshop
<i>NASA Exoplanet Science Institute</i> | July 2022
\$1,500 |
| Ben Barres Fellowship
<i>Out to Innovate (formerly known as NOGLSTP)</i>
Support for travel to CTIO and fees for one publication | January 2021
\$4,200 |

Sigma Xi Grant in Aid of Research <i>Sigma Xi, the Scientific Research Honor Society</i> Support for travel to CTIO to complete proposed research	January 2020 \$2,700
Travel support and invitation to present at ExoPAG 19 <i>2019 Meeting of NASA's Exoplanet Program Analysis Group</i>	January 2019 \$700

OBSERVING TIME AWARDED

PI = Vrijmoet for all, unless otherwise noted

HRCam+SAM (at SOAR 4.1m):

<i>Prepping the Ingredients to Make Mass Measurements from Gaia for Multi-Decade M Dwarf Orbits</i>	0.5 nights/semester, 2023A – 2024B, NOIRLab (long-term)
<i>Orbital Architectures of M Dwarf Binaries</i>	1.0 nights/semester, 2022B – 2023A, NOIRLab (long-term)
<i>Orbital Architectures of M Dwarf Binaries</i>	1.5 nights/semester, 2020B – 2022A, NOIRLab (long-term)
<i>Orbital Architectures of M Dwarf Binaries</i>	1.5 nights in 2020A, NOIRLab
<i>Orbital Architectures of M Dwarf Systems</i>	2 nights in 2019B, NOAO

All of the above: Speckle imaging of ~ 350 M dwarf binary pairs to map their orbits (PhD thesis).

CHIRON (at CTIO 1.5m):

<i>Discovering Spectroscopic Companions to Nearby, Southern M Dwarfs</i> (PI: J. Winters)	5 nights in 2022B – 2023A, NOIRLab (long-term)
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OBSERVING EXPERIENCE

CTIO/SMARTS 0.9m Telescope <i>Cerro Tololo Inter-American Observatory (CTIO)</i> Astrometry and photometry for RECONS team	54 nights classical, 2018A – 2019B, 2023A ~ 21 nights remote, 2020A – 2022A
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As the **SMARTS Graduate Fellow** for the 0.9m, I assisted guest users, updated the observing manual, kept working knowledge of the telescope and observatory operations and procedures, and served as liaison for the 0.9m at conferences. I also organized and processed (bias-subtract, flat-field) the RECONS astrometry and photometry data after each observing run (~ 80 nights or $\sim 8,300$ frames per year).

STUDENT RESEARCH MENTORING

Nathan Holden, undergraduate at Georgia State University <i>Astrometric orbit and long-term variability of AT Mic AB (AAS poster)</i>	June 2022 – present
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TEACHING

Smith College

Astronomy 341, as **instructor of record** Spring 2024
 “Observational Techniques II”

Students complete a 6-night observing run at Perkins Telescope Observatory to take photometric time-series data on low-mass stars, then they carry out projects of their own design using those data. Students receive extensive instruction in writing and reviewing professional-level observing proposals while they design their projects, and ultimately they present their projects in AAS-style posters to the rest of FCAD.

Astronomy 337, as **co-instructor of record** (with Prof. K. Ward-Duong) Fall 2023
 “Observational Techniques I”

This course introduces students to the considerations of optical observing and data analysis. The 3-hour class sessions involve lectures, discussions, and lab activities with Jupyter Notebooks. Students also take photometric data on star clusters of their choosing using the Smith rooftop 20-in telescope, write pipelines to reduce those data, and fit isochrones to those clusters to estimate their ages.

Georgia State University

Astronomy 1500, as **instructor of record** Fall 2021
 “Life in the Universe”

Students investigate how life arose on Earth through planetary sciences, biology, and geology, then they extend these concepts to investigate the potential for life to arise on exoplanets. Exoplanet detection techniques and statistics are extensively discussed. For this 50-student course I wrote and presented all lectures, designed all the homework and projects, and graded student work personally.

Astronomy 1010 (Lab), as Teaching Assistant 8 lab classes, spread over 2017 – 2018
 “Solar System and Planetary Astronomy”

Astronomy 1020 (Lab), as Teaching Assistant 8 lab classes, spread over 2016 – 2019
 “Stellar and Extragalactic Astronomy”

Both Astro 1010 (above) and 1020: Guided hands-on activities in the introductory lab classes, covering stellar structure, stellar evolution, and the distance ladder (Astro 1020), and celestial coordinates, Moon phases and features, Kepler’s laws, and Solar System structure (Astro 1010). Also graded all student work, organized and led observing sessions in downtown Atlanta, and occasionally served as guest lecturer for the concurrent lecture courses.

San Diego State University

Astronomy 109 (Lab), as Teaching Associate Spring 2015 – Spring 2016
 “Astronomy Laboratory”

Developed, presented, and guided lectures and activities for the introductory astronomy lab class. Topics covered included celestial coordinates, Kepler’s laws, galaxy morphology, dark matter, variable stars, and exoplanets. Also graded student work, held office hours, and supervised field trips to SDSU’s Mount Laguna Observatory.

SERVICE & OUTREACH

Sexual-Orientation and Gender Minorities in Astronomy, member December 2020 – present
American Astronomical Society Committee

Our committee of ~10 astronomers from a variety of career levels and institution types works together to promote equity and foster inclusion for LGBT+ people within astronomy. We meet monthly as a committee, and at least twice yearly we host networking and discussion events for the broader community.

FCAD Colloquium Committee, **member** July 2023–present
Five College Astronomy Department, Univ. Massachusetts Amherst, Amherst, MA

Taskforce for Diversity, Equity, & Inclusion, **co-chair** December 2020 – February 2023
Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA

With a faculty member, I co-led 10 faculty and grads to develop improvements for department climate. Initiatives we have completed include a clothing drive, curating/adding DEI info to the department website, guiding the launch of a peer mentoring program for our physics grads (à la AstroPALs, below), and developing a system for giving anonymous feedback to department leadership.

Astronomy Peer Advising Leaders (AstroPAL), mentor (prev. **liaison** & **president**)
Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA August 2018 – July 2023

(August 2018 – July 2023) As a **mentor**, I was a near-peer advisor for a 1st- or 2nd-year astro grad student (one or two per year). We met monthly one-on-one to discuss navigating grad school.

(August 2019 – July 2020) As **liaison**, I provided training to AstroPAL mentors, led monthly focus groups for mentees on academic and interpersonal topics, and maintained knowledge of campus resources. I represented our group to the faculty regarding department environment and curricula.

(August 2020 – July 2022) As **president**,

- I completed the admin steps to keep AstroPAL an official GSU club: submitting annual budget requests, tracking the budget, and attending GSU Student Org meetings.
- Within AstroPAL, I organized and led our monthly mentor meetings, kept minutes, maintained/updated our website, and supported the AstroPAL liaison as needed.
- Each spring, I organized practice oral qualifying exams (“mock quals”), arranging committees of senior grads to act as “mock examiners” for each 2nd-year grad to simulate their quals. I also participated as an examiner and wrote mock quals questions for the group.

“Making scientific posters” info session for undergrad researchers 3 August 2022
Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA

Science fair judge at Carver Early College Science & Engineering Fair 5 December 2019
Carver Early College High School, Atlanta, GA

“Applying to grad school” info session for undergrad researchers 9 July 2019
Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA

Georgia Outreach Team for Space (**GOT Space**) talk and Q&A 24 January 2019
Maynard Holbrook Jackson High School, Atlanta, GA

Discussed exoplanets and the Solar System with Ms. Jones’s environmental studies class.

Hard Labor Creek Observatory Open House Nights 7 nights over 2016 – 2019
Hard Labor Creek State Park, Rutledge, GA

Within a team of several astronomers, I guided the public in viewing stars and nebulae using a variety of telescopes. These events include demonstrating how the telescopes work, describing research observations, and discussing interesting facts about that night’s targets.

Georgia Science Olympiad March 2017
Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA

With a group of grads, designed and led an activity about stellar evolution for elementary school students.

PROFESSIONAL EXPERIENCE OUTSIDE ASTRONOMY

Extanto Technology

Quality Assurance and Subject Matter Expert

for Astronomy, Physics, and Chemistry

December 2013 – November 2015

for Math

December 2011 – March 2012

Verified and maintained accuracy and functionality of digitized textbooks and related online learning tools. Tasks included checking written problems for accuracy and consistency with the source material; verifying functionality of software tools; filing concise, descriptive reports of each error found; and updating old reports to indicate if errors have been fixed or need additional attention.