Dr. Eliot Halley Vrijmoet

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Northampton, MA 01063

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evrijmoet@smith.edu

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* (defense recording available)
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

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

Papers Submitted or Nearing Submission (In-Prep)

The Solar Neighborhood. LVI. 42 Orbits of M Dwarf Binaries from the CTIO/SMARTS 0.9m Astrometry Program
Vrijmoet, E. H., Matthews, A., Williams, L., Henry, T. J., Kar, A., & Jao, W.-C. in prep (to submit February 2026).

Papers as First-Author or with Substantial Contributions

The Solar Neighborhood. LIV. 54 Orbits of M Dwarf Binaries from SOAR Speckle Interferometry
Vrijmoet, E. H., Tokovinin, A., Henry, T. J., Winters, J. G., Horch, E., & Jao, W.-C., 2026, accepted to AJ, in press.

Are We There Yet? Challenges in Quantifying the Frequency of Earth Analogues in the Habitable Zone
Fernandes, R. B., Johnson, S., Bergsten, G. J., [...], **Vrijmoet, E. H.**, et al. 2025, PASP, 137, 12, 121001

The Solar Neighborhood LII: M Dwarf Twin Binaries – Presumed Identical Twins Appear Fraternal in Variability, Rotation, Hα, and X-rays
Couperus, A. A., Henry, T. J., Osten, R. A., Jao, W.-C., **Vrijmoet, E. H.**, et al. 2024, AJ, 169, 41

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, AJ, 167, 196

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

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 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

..... *Papers with Minor Contributions* .....

The Solar Neighborhood. LV. M Dwarf Twin Binaries – One in Five Twin Sibling Pairs Are Mismatched in Activity and/or Rotation
Couperus, A. A., Henry, T. J., Kar, A., Jao, W.-C., **Vrijmoet, E. H.**, Osten, R. A. 2024, accepted, in press (arXiV:2510.22093)

A Demonstration of Interstellar Navigation Using New Horizons
Lauer, T. R., Munro, D. H., Spencer, J. R., [...], **Vrijmoet, E. H.**, et al. 2025, AJ, 170, 1

A 7-Day Multi-Wavelength Flare Campaign on AU Mic. II: Electron Densities and Kinetic Energies from High-Frequency Radio Flares
Tristan, I. I., Osten, R. A., Notsu, Y., [...], **Vrijmoet, E. H.** 2025, ApJ, 1, 53

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

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

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

Turning the Tides for Binary M-Dwarfs: Evidence for Circularization at One Week
16 January 2025, Contributed Talk
245th Meeting of the American Astronomical Society (National Harbor, MD)

Exploring Substellar(ish) Companions of Low-Mass Stars with Astrometry
24 July 2024, Contributed Talk
Connecticut Exoplanet Picnic (Wesleyan Univ., Middletown, CT)

Surveying Orbital Architectures — Big and Small — for the Histories of Our M Dwarf Neighbors
27 June 2024, **Contributed Plenary**
Cool Stars 22 (San Diego, CA)

⋆ *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 substantial contributions by E. H. Vrijmoet among 20 coauthors)
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)

Selected Poster Presentations

AAS = American Astronomical Society

Searching Around the Lowest-Mass Stars for Substellar Companions
22 May 2025, Poster, New York Area Exoplanets Meeting II

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)

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, 237$^{\text{th}}$ Meeting of the AAS (virtual)

Statistics of Triple Star Systems in the Kepler Field
June 2016, Poster #218.10, 228$^{\text{th}}$ Meeting of the AAS (San Diego, CA)

Teaching

Five College Astronomy Dept., Smith College, Northampton, MA

Astronomy 341, as **instructor of record** — Spring 2024, Spring 2025, Spring 2026
"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 carry out projects of their own design using those data. To design these projects, students focus on writing and reviewing professional-level observing proposals, and ultimately they present their work in AAS-style posters to the Five College Astro. Department.

Astronomy 200, as guest lecturer — 10 March 2025
"Astronomical Data Science"
Lecture on null vs. alternative hypotheses, assessing significance (e.g., p-values), and statistical tests.

Astronomy 337, as **instructor of record** — Fall 2024
and as **co-instructor of record** (with Prof. K. Ward-Duong) — Fall 2023
"Observational Techniques in Optical and Infrared Astronomy"
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, then they write pipelines to reduce those data and fit isochrones to those clusters to estimate their ages.

Dept. of Physics and Astronomy, Georgia State University, Atlanta, GA

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"
Guided hands-on lab activities covering celestial coordinates, Moon phases and features, Kepler's laws, and the Solar System. Graded all student work (24 students/class) and led rooftop observing sessions in downtown Atlanta.

Astronomy 1020 (Lab), as Teaching Assistant — 8 lab classes, spread over 2016 – 2019
"Stellar and Extragalactic Astronomy"
Guided hands-on lab activities covering stellar structure, stellar evolution, and the distance ladder. Graded all student work (24 students/class), led rooftop observing sessions in downtown Atlanta, and occasionally served as guest lecturer for the Astro 1020 lecture course.

..... Dept. of Astronomy, San Diego State University, San Diego, CA .....

Astronomy 109 (Lab), as Teaching Associate — 5 lab classes, spread over 2015 – 2016
"Astronomy Laboratory"
Developed, presented, and guided activities on celestial coordinates, Kepler's laws, galaxy morphology, dark matter, variable stars, and exoplanets. Graded all student work (24 students/class), held office hours, and supervised field trips to SDSU's Mount Laguna Observatory.

Student Research Mentoring

28 students total from 6 institutions

Alette Matthews, undergraduate at Smith College — June 2024 – present
Characterizing very low-mass binaries using ground-based astrometry (AAS poster)

Susan Niu, undergraduate at Smith College — January 2025 – May 2025
(jointly advised with K. Ward-Duong)
Fitting orbits of substellar companions using RV and astrometry

Lucy Williams, undergraduate at Smith College — June 2024 – January 2025
Exploring marginally-detected binaries with ground-based astrometry (AAS poster)

Nathan Holden, undergraduate at Georgia State University — June 2022 – August 2023
Astrometric orbit and long-term variability of AT Mic AB (AAS poster)

..... Students mentored (12 total) in the Spring 2025 AST 341 research course .....
(each student led their own project, with minor collaboration from classmates)

Projects involving fitting eclipsing binary star models to light curves:
Ronnie Banerjee, Jacqueline Byrne, Sam Sabia, Alex Grosman
undergraduates at UMass Amherst and Hampshire College

Projects on characterizing the brown dwarf triple system TIC 676:
Josh Duffy, Dan Kidwell, Jackie Magner
undergraduates at UMass Amherst

Projects on flare rates and energies in low-mass stars:
Sam Kleiman, David Marroquín Argüello, Meghan McBride, Danny Nguyen, Jeremy Sun
undergraduates at Amherst College and UMass Amherst

..... Students mentored (11 total) in the Spring 2024 AST 341 research course .....
(each student led their own project, with minor collaboration from classmates)

Projects involving searching for unresolved companions using eclipsing binary light curves:
Nisa Colmek, Kai Fernandes, Becca Michelson
undergraduates at Amherst College and Smith College

Projects on flare rates and energies in low-mass stars:
Sean Brown, Valentina Flores, Gena Levin, Patricia Molinari
undergraduates at Amherst College, Mt. Holyoke College, Smith College, and UMass Amherst

Projects on misc. topics: instrumentation, tides, circumstellar disks, galaxy characterization
Kieran Dowd, Klara Matuszewska, Ash Messier, Ian Wolter
undergraduates at Amherst College, Smith College, and UMass Amherst

Grants & Awards

$14,177 total

CFCD Student Research Assistance Grant — January 2025
Committee on Faculty Compensation and Development, Smith College — $2,577
Support for two student research assistants for one semester

CFCD Student Research Assistance Grant — September 2024
Committee on Faculty Compensation and Development, Smith College — $2,000
Support for two student research assistants for one semester

Outstanding Senior Graduate Student Award — April 2023
Dept. of Physics and Astronomy, Georgia State Univ. — $500

Chambliss Astronomy Achievement Student Award, Honorable Mention — July 2022
240th Meeting of the American Astronomical Society

Support for travel to the 2022 Sagan Summer Sessions Workshop — July 2022
NASA Exoplanet Science Institute — $1,500

Ben Barres Fellowship — January 2021
Out to Innovate (formerly known as NOGLSTP) — $4,200
Support for travel to CTIO and fees for one publication

Sigma Xi Grant in Aid of Research — January 2020
Sigma Xi, the Scientific Research Honor Society — $2,700
Support for travel to CTIO to complete proposed research

Travel support and invitation to present at ExoPAG 19 — January 2019
2019 Meeting of NASA's Exoplanet Program Analysis Group — $700

Observing Time Awarded

PI = Vrijmoet for all, unless otherwise noted

MAROON-X (at Gemini-N 8.1m):

RV Snapshots of (Sub)stellar companions to the Very Lowest Mass Stars — 7.2 hours in 2025A, NOIRLab

HRCam+SAM (at SOAR 4.1m):

Prepping the Ingredients to Make Mass Measurements from Gaia for Multi-Decade M Dwarf Orbits — 0.5 nights/semester, 2024A – 2025A, NOIRLab (long-term)

The Final Luminosity and Mass Functions for M Dwarfs (PI: M. Leblanc) — 1.0 nights in 2025A, NOIRLab

M-Dwarf Companions: The Soar Speckle Search (PI: M. Leblanc) — 1.0 nights in 2024A, NOIRLab

Orbital Architectures of M Dwarf Binaries — 1.0 nights/semester, 2022B – 2023A, NOIRLab (long-term)

Orbital Architectures of M Dwarf Binaries — 1.5 nights/semester, 2020B – 2022A, NOIRLab (long-term)

Orbital Architectures of M Dwarf Binaries — 1.5 nights in 2020A, NOIRLab

Orbital Architectures of M Dwarf Systems — 2 nights in 2019B, NOAO

CHIRON (at CTIO 1.5m):

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

Observing Experience

Perkins 1.8m Telescope — 18 nights classical, 2024A – 2026A
Perkins Telescope Observatory (PTO), Flagstaff, AZ
Time-series photometry for AST341 student projects (see "Teaching," above)

Smith College 20-in Telescope — 7 half-nights classical, 2023B – 2024B
Smith College, Northampton, MA
Photometry of star clusters for AST337 student projects (see "Teaching," above)

CTIO/SMARTS 0.9m Telescope — 54 nights classical, 2018A – 2019B, 2023A
Cerro Tololo Inter-American Observatory (CTIO), Chile — ∼21 nights remote, 2020A – 2022A
Astrometry and photometry for RECONS team

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 ∼8,300 frames per year).

Service & Outreach

Committees and Extended Commitments

Sexual-Orientation and Gender Minorities in Astronomy — December 2020 – present
American Astronomical Society Committee — **co-chair** since September 2024
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 — July 2023 – present
Five College Astronomy Department, Univ. Massachusetts Amherst, Amherst, MA

FCAD Star & Planet Formation Seminar Organizing Committee — July 2023 – July 2024
Five College Astronomy Department, Amherst College, 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. We completed initiatives such as 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 school 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, 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.

Individual Service/Outreach Events

Smith College Rooftop Observatory Open House Nights 2 nights over 2024 – 2025
Smith College, Northampton, MA
Guided the public in viewing star clusters and nebulae using the 20-in research telescope. These events included demonstrating the telescope features and discussing details about the objects in view.

Research talk for Summer Science & Engineering Program 1 August 2024
Smith College, Northampton, MA

Panelist for "Careers Beyond Graduate School" GSU alumni discussion 16 April 2024
Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA

Podcast Guest on "Starts with a Bang!" Episode #86 1 October 2022
Hosted online by Dr. Ethan Siegel

Leader for "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

Panelist for "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, on each night 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.

Activity leader for Georgia Science Olympiad March 2017

Dept. of Physics and Astronomy, Georgia State Univ., Atlanta, GA

Designed and led an activity about stellar evolution for local 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.