Benjamin M. Tofflemire

51 Pegasi b Postdoctoral Fellow

CONTACT INFORMATION

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RESEARCH INTERESTS

T Tauri stars, formation and evolution of binary stars, accretion diagnostics, magnetic reconnection events, structure and evolution of protoplanetary disks, time-domain astrophysics

EMPLOYMENT APPOINTMENTS

51 Pegasi b Postdoctoral Fellow, UT-Austin – Faculty Host: Prof. Adam Kraus	2020-present
Postdoctoral Fellow, UT-Austin – Advisor: Prof. Adam Kraus	2018-2020
Research Assistant, UW-Madison – Advisor: Prof. Robert Mathieu	2013-2018
Research Assistant, UW-Madison – Advisor: Dr. Marina Orio	2011-2013
Research Assistant, Univ. of Washington – Advisor: Prof. John Wisniewski	2010-2011

EDUCATION

Ph.D. Astronomy — **July 2018**
University of Wisconsin-Madison — Madison, WI, USA
- Advisor: Professor Robert D. Mathieu
- Thesis: *Accretion Dynamics in Pre-Main Sequence Binary Stars*

B.S. Astronomy & Physics — **June 2011**
University of Washington — Seattle, WA, USA

RESEARCH EXPERIENCE

Characterizing Young Eclipsing Binaries — **July 2018 - present**
- Determine orbital solutions and fundamental stellar parameters for a sample of pre-main sequence eclipsing binaries to test models of stellar evolution
- Utilize NIR spectra from IGRINS and light curves from *K2* and *Spitzer*

THYME – *TESS* Hunt for Young and Maturing Exoplanets — **July 2018 - present**
- Lead spectroscopic followup of *TESS* planet candidates discovered in young associations
- Characterizing stellar host properties and radial-velocity variability

Graduate Research Assistant — University of Wisconsin-Madison
Advisor: Prof. Robert D. Mathieu — **June 2012 - present**
- Measured the accretion rate for a sample of 9 pre-main sequence binaries as a function of orbital phase to test numerical models of binary accretion
- Characterized the kinematics and spatial distribution of accretion streams feeding young binary star systems with time-series, high-resolution spectroscopy
- Determined membership and binary population of evolved stars in the open cluster NGC 6791, as part of the WIYN Open Cluster Study, through multi-epoch, radial-velocity measurements

Advisor: Dr. Marina Orio — **August 2011 - December 2013**
- Modeled *Chandra* and *XMM-Newton* X-ray grating spectra of recurrent novae to determine white dwarf photospheric temperatures and the physical characteristics of ejected material

NSF Research Experiences for Undergraduates — University of Wisconsin-Madison
Advisor Prof. Alex Lazarian — **June 2010 - January 2011**
- Analyzed MHD simulations of ISM turbulence in search of statistical relationships between observable quantities (column density distributions) and magnetic field strength

Undergraduate Research Assistant — University of Washington
Advisor: Prof. Suzanne Hawley and Prof. John Wisniewski — **September 2009 - Nov 2011**
- Characterized the near-infrared variability of magnetic reconnection events on M dwarfs

AWARDS

51 Pegasi b Postdoctoral Fellowship in Planetary Astronomy	($375,000) **2020**
TESS Cycle 3 Guest Investigator Program	($75,000) **2020**
University of Wisconsin Jansky Award for Outstanding Research	**2017**

UW-Madison Graduate School Conference Presentation Award	($2,400) **2015, 2016, 2017**
Sigma Xi Grants in Aid of Research	($2,500) **2015**
University of Wisconsin Bautz Travel Fellowship	($1200) **2015**
University of Wisconsin Vilas Research Travel Grant	($600) **2015**
AAS 225 Chambliss Student Prize Honorable Mention	**2015**
University of Wisconsin – University Housing Honored Instructor	**2012**
University of Washington's Astronomy Bear Prize Recipient	**2011**
University of Washington Mary Gates Research Scholarship	($4,000) **2010, 2011**

Successful Observing Proposals

ALMA Cycle 7
- **PI:** Planet Formation and Survival in Newly-Forming Binary Systems (16 hr)

Spitzer DDT
- **PI:** Precision Measurements of Stellar Radii in Young Eclipsing Binaries (94 hr: Priority 1)

IGRINS/Gemini-South
- **PI:** The Empirical Mass-Radius Relation from 10 to 600 Myr (24 hr: Band 1)

IGRINS/DCT
- **PI:** Determining Orbital Solutions for Young Eclipsing Binaries (30 hr)

Southern African Large Telescope
- **PI:** Time-Series Spectroscopy of Pre-Main Sequence Binaries (42.5 hr: P0/P1)

WIYN 3.5-m Telescope
- **PI:** Radial velocity survey of accreting stars in NGC 2264 (2 nights)
- **PI:** Time-series spectroscopy of flare stars in Pleiades star cluster (3 nights)
- Co-I: WIYN Open Cluster Study radial-velocity survey ($\sim$ 90 nights over 8 semesters)

Las Cumbres Observatories Global Telescope Network
- Co-I: Time-series photometry of Pre-Main Sequence Binaries (980 hr over 5 semesters)

SMARTS 1.3m
- **PI:** Time-series photometry of Pre-Main Sequence Binaries (107 hours over 4 semesters)
- **PI:** Time-series spectroscopy of Pre-Main Sequence Binary V4046 Sgr (42 hs)

WIYN 0.9-m Telescope
- **PI:** High Cadence Photometry of Pre-Main Sequence Binary DQ Tau (16 nights)

APO: ARCSAT 0.5m
- **PI:** High Cadence Photometry of Pre-Main Sequence Binary DQ Tau (16 nights)

KPNO: 2.1m
- Co-I: High Cadence, NIR Photometry of M Dwarf Flare Stars (5 nights)

Talks

Cool Stars 20 Contributed Talk	**August 2018** Boston, MA
AAS 231 Dissertation Talk	**January 2018** National Harbor, MD
Vanderbilt University Astrophysics Lunch	**November 2017** Nashville, TN
Institute for Theory and Computation (Harvard-CfA) Stars and Planets Seminar (Invited)	**March 2017** Cambridge, MA
American Museum of Natural History Astronomy Seminar	**March 2017** New York, NY
Space Telescope Science Institute Exoplanets, Star and Planet Formation Seminar	**March 2017** Baltimore, MD
University of Texas-Austin Stars Seminar (Invited)	**October 2016** Austin, TX

Cool Stars 19 **June 2016**
Contributed Talk Uppsala, Sweden

Science with SALT **June 2015**
Contributed Talk Stellenbosch, South Africa

X-ray Binaries - 50 Years Since the Discovery of Sco X-1 **July 2012**
Contributed Talk Chandra X-ray Center, Boston, MA

Service

NASA ADAP Review Panel	**2020**
BashFest 2019 SOC (UT-Austin)	**2019**
Host & Organizer: ISM/Star Formation/Exoplanets Seminar (UT-Austin)	**2019**
UW-Madison Astronomy Graduate Admissions Committee (Elected)	**2015 - 2016**
NASA ROSES Review Panel Secretary	**2015**
Graduate Student-Faculty Liaison (Elected)	**2014 - 2015**
Undergraduate Liaison to the Univ. of Washington Astronomy Department	**2010 - 2011**
Stars Coffee Curator (weekly department meeting)	**2013 - present**

Mentoring Experience

TAURUS Mentor Training **Summer 2019**
- Developed and facilitated a mentor training seminar for professors, postdocs, and grad students advising TAURUS Scholars

TAURUS & NSF REU Advising **Summer 2019**
- Advisor to two students (Miguel Gutierrez, Victoria Catlett) on a project to measure accretion-tracing emission lines in NIR spectra, both attended the 235 Winter AAS and published RNAAS

DELTA (CIRTL) Mentor Training Seminar **Summer 2014**
Class focused on establishing realistic expectations, considering the issues of human diversity, and developing a reflective approach to mentoring

UW-Madison Undergrad Research **June 2015 - June 2017**
Graduate Student Mentor University of Wisconsin-Madison
- Advised Nathan Eggen (currently a University of Minnesota graduate student) on project to produce and model the lightcurves of Pre-Main Sequence binary stars

NSF REU **June - August 2014**
Graduate Student Mentor University of Wisconsin-Madison
- Co-advised Sarah Kessler (currently an Ohio State graduate student) and Francis Klein on a project searching for triple companions to spectroscopic binaries in open cluster M67 using *HST*

EAGLE School Science Mentor **Spring 2015**
Science Mentor Madison, WI
- Held weekly meetings with junior-high student Josh DuBeau to create a class presentation on stellar evolution and exoplanet detection

Teaching Experience

Course Development & Teaching
Astronomy 140: The Exoplanet Revolution University of Wisconsin-Madison
- Co-developed curriculum and labs for an intro-level, inquiry-based course on exoplanets with Prof. Mathieu
- Co-taught first implementation of course with Prof. Mathieu in Spring 2018

Astronomy 307: Introductory Astronomy The University of Texas at Austin
- Guest lectured an activity based lesson on parallax and absolute magnitudes

Teaching Assistant **Fall 2012, Fall 2015**
Astronomy 103: The Evolving Universe University of Wisconsin-Madison
- Taught six discussion sections per week, which included developing lesson plans and in-class activities

Outreach

Universe in the Park **2011-present**
- Visit Wisconsin state parks to host public observing and astronomy presentations (>15 events hosted)

Washburn Public Observing Nights **2011-present**
- Host public and private observing nights at the historic Washburn observatory (>15 events hosted)

Girls Inc. Planetarium Shows **2014**
- Presented planetarium shows to Madison's local chapter of Girls Inc.

Space Place **November 2016**
- Invited lecture to amateur astronomy community (televised) Madison, WI

Senior Summer School **July 2014**
- Invited lecture to the Senior Summer School educational, vacation program Chicago, IL

Technical Skills

Programming Languages
- Experienced: python, IDL, HTML
- Basic Knowledge: Fortran, SQL

Tools
- LaTeX, IRAF, DS9, Source Extractor, Git, Jekyll (web development)

Peer-Reviewed Publications (h-index: 15)

First Author Publications

8. **Tofflemire**, B. M., Rizzuto, A. C., Newton, E. R., et al. 2021, AJ, 161, 171
TESS Hunt for Young and Maturing Exoplanets (THYME) V: A Sub-Neptune Transiting a Young Star in a Newly Discovered 250 Myr Association

7. **Tofflemire**, B. M., Mathieu, R. D., Johns-Krull, C. 2019, AJ, 158, 245
Accretion Kinematics in the T Tauri Binary TWA 3A: Evidence for Preferential Accretion onto the TWA 3A Primary

6. **Tofflemire**, B. M., Mathieu, R. D., Herczeg, G. J., Akeson, R. L., & Ciardi, D. R. 2017b, ApJL, 842, L12
Pulsed Accretion in the T Tauri Binary TWA 3A

5. **Tofflemire**, B. M., Mathieu, R. D., Ardila, D. R., Akeson, R. L., Ciardi, D. R., Johns-Krull, C., Herczeg, G. J., & Quijano-Vodniza, A. 2017a, ApJ, 835, 8
Accretion and Magnetic Reconnection in the Classical T Tauri Binary DQ Tau

4. **Tofflemire**, B. M., Gosnell, N. M., Mathieu, R. D., & Platais, I. 2014, AJ, 148, 61
WIYN Open Cluster Study. LIX. Radial Velocity Membership of the Evolved Population of the Old Open Cluster NGC 6791

3. **Tofflemire**, B. M., Orio, M., Page, K. L., Osborne, J. P., Ciroi, S., Cracco, V., Di Mille, F., & Maxwell, M. 2013, ApJ, 779, 22
X-Ray Grating Observations of Recurrent Nova T Pyxidis during the 2011 Outburst

2. **Tofflemire**, B. M., Wisniewski, J. P., Kowalski, A. F., Schmidt, S. J., Kundurthy, P., Hilton, E. J., Holtzman, J. A., & Hawley, S. L. 2012, AJ, 143, 12
The Implications of M Dwarf Flares on the Detection and Characterization of Exoplanets at Infrared Wavelengths

1. **Tofflemire**, B. M., Burkhart, B., & Lazarian, A. 2011, ApJ, 736, 60
Interstellar Sonic and Alfvénic Mach Numbers and the Tsallis Distribution

Co-Author Publications

20. Reipurth, B., Rice, T., **Tofflemire**, B (2 co-authors), in prep
Two Unusual Young Variables in NGC 1333

19. Kidder, B., Mace G., Lopez-Valdivia, R., et al. (including **Tofflemire**, B. and 4 co-authors) 2021, ApJ, submitted
The IGRINS YSO Survey: Veiling Spectra of Pre-Main-Sequence Stars in Taurus-Auriga

18. Newton, E., Mann, A., Kraus, A., et al. (including **Tofflemire**, B. and 49 co-authors) 2021, AJ, 161, 65
TESS Hunt for Young and Maturing Exoplanets (THYME). IV. Three Small Planets Orbiting a 120 Myr Old Star in the Pisces-Eridanus Stream

17. Waalkes, W., Berta-Thompson, Z., Collins, K., Feinstein, A., **Tofflemire**, B., et al. (36 co-authors) 2021, AJ, 161, 13
TOI 122b and TOI 237b: Two Small Warm Planets Orbiting Inactive M Dwarfs Found by TESS

16. Nine, A., Milliman, K., Mathieu, R., et al. (including **Tofflemire**, B. and 3 co-authors) 2020, AJ, 160, 169
WIYN Open Cluster Study. LXXXII. Radial-velocity Measurements and Spectroscopic Binary Orbits in the Open Cluster NGC 7789

15. Rizzuto, A., Newton, E., Mann, A., **Tofflemire**, B et al. (13 co-authors) 2020, AJ, 160, 33
TESS Hunt for Young and Maturing Exoplanets (THYME). II. A 17 Myr Old Transiting Hot Jupiter in the Sco-Cen Association

14. Pearce, L.,Kraus, AL., Dupuy, T., et al. (including **Tofflemire**, B. and 3 co-authors) 2020, ApJ, 894, 115P, *Orbital Parameter Determination for Wide Stellar Binary Systems in the Age of Gaia*

13. Newton, E., Mann, A., **Tofflemire**, B., et al. (49 co-authors) 2019, ApJL, 880L, 17N
TESS Hunt for Young and Maturing Exoplanets (THYME) I: A planet in the 45 Myr Tucana-Horologium association

12. Kounkel, M., Covey, K., Moe, M., et al. (including **Tofflemire**, B. and 25 co-authors) 2019, AJ, 157, 196K
Close companions around young stars

11. Zemko, P., Ciroi, S., Orio, M., et al. (including **Tofflemire**, B. and 8 co-authors) 2018, MNRAS, 480, 4489Z
Optical Observations of Novae in Quiescence

10. Peretz, U., Orio, M., Behar, E., Bianchini, A., Gallagher, J., Rauch, T., **Tofflemire**, B., & Zemko, P., 2016, ApJ 829, 2
Chemical and Physical Parameters from X-Ray High-resolution Spectra of the Galactic Nova V959 Mon

9. Milliman, K., Leiner, E., Mathieu, R., **Tofflemire**, B., & Platais, I. 2016, AJ, 151, 152
WIYN Open Cluster Study. LXXI. Spectroscopic Membership and Orbits of NGC 6791 Sub-Subgiants

8. Mack, C., III, Ge, J., Deshpande, R., et al. (including **Tofflemire**, B. and 41 co-authors) 2013, AJ, 145, 139
A Cautionary Tale: MARVELS Brown Dwarf Candidate Reveals Itself to be a Very Long Period, Highly Eccentric Spectroscopic Stellar Binary

7. Orio, M., Behar, E., Gallagher, J., Bianchini, A., Chiosi, E., Luna, G., Nelson, T., Rauch, T., Schaefer, B., & **Tofflemire**, B., 2013, MNRAS, 429, 1342
Thomson scattering and collisional ionization in the X-ray grating spectra of the recurrent nova U Scorpii

6. Fleming, S. W., Ge, J., Barnes, R., et al. (including **Tofflemire**, B. and 58 co-authors) 2012, AJ, 144, 72
Very Low Mass Stellar and Substellar Companions to Solar-like Stars from MARVELS. II. A Short-period Companion Orbiting an F Star with Evidence of a Stellar Tertiary and Significant Mutual Inclination

5. Wisniewski, J. P., Ge, J., Crepp, J. R., et al. (including **Tofflemire**, B. and 41 co-authors) 2012, AJ, 143, 107
Very Low Mass Stellar and Substellar Companions to Solar-like Stars from MARVELS. I. A Low-mass Ratio Stellar Companion to TYC 4110-01037-1 in a 79 Day Orbit

4. Sayres, C., Subasavage, J. P., Bergeron, P., Dufour, P., Davenport, J., AlSayyad, Y., & **Tofflemire**, B., 2012, AJ, 143, 103
A Multi-survey Approach to White Dwarf Discovery

3. Schmidt, S., Kowalski, A., Hawley, S., Hilton, E., Wisniewski, J., & **Tofflemire**, B., 2012, ApJ, 745, 14
Probing the Flare Atmospheres of M Dwarfs Using Infrared Emission Lines

2. Hornbeck, J., Grady, C., Perrin, M., Wisniewski, J., **Tofflemire**, B., et al. (11 co-authors) 2012, ApJ, 744, 54
PDS 144: The First Confirmed Herbig Ae-Herbig Ae Wide Binary

1. Janson, M., Carson, J., Thalmann, C., et al. (including **Tofflemire**, B. and 44 co-authors) 2011, ApJ, 728, 85
Near-infrared Multi-band Photometry of the Substellar Companion GJ 758 B

Engineering Publications

2. Eisenstein, D., et al. (including **Tofflemire**, B. and 242 co-authors) 2011, AJ, 142, 72E, *SDSS-III: Massive Spectroscopic Surveys of the Distant Universe, the Milky Way, and Extra-Solar Planetary Systems*

1. Aihara, H., et al. (including **Tofflemire**, B. and 178 co-authors) 2011, ApJS, 193, 29A, *The Eighth Data Release of the Sloan Digital Sky Survey: First Data from SDSS-III*

Other Publications

Student Publications

2. Gutiérrez, M., Catlett, V., **Tofflemire**, B., Mace, G., Kraus, A. 2020, RNAAS, 4, 7, *Constraining Temperature and Density of Accretion Flows in T Tauri Stars from Brackett Line Ratios*

1. Catlett, V., Gutiérrez, M. and **Tofflemire**, B., Mace, G., Kidder, B., Kraus, A., 2019, RNAAS, 3, 195, *Near-infrared Accretion Diagnostics of Young Stellar Objects*

Conference Proceedings

4. **Tofflemire**, B., Mathieu, R., Herczeg, G., et al. 2017, Francesco's Legacy: Star Formation in Space and Time, Memorie della Società Astromonica Italiana, Vol 88 n. 4, 820
Accretion Dynamics in Pre-main Sequence Binaries

3. **Tofflemire**, B., 2015, SALT Science Conference 2015 (SSC2015), 26
Accretion Dynamics in Pre-Main Sequence Binaries

2. **Tofflemire**, B., 2012, X-ray Binaries. Celebrating 50 Years Since the Discovery of Sco X-1, 57
X-ray Grating Observations of Recurrent Nova T Pyx

1. **Tofflemire**, B., Wisniewski, J., Hilton, E., et al. 2011, 16th Cambridge Workshop on Cool Stars, Stellar Systems, and the Sun, 448, 1287
M Dwarf Flares: Exoplanet Detection Implications

Conference Abstracts

7. **Tofflemire**, B., Newton, E., Mann, A., et al. 2020, American Astronomical Society Meeting Abstracts, 235, 174.18
THYME: The TESS Hunt for Young and Maturing Exoplanets – Project Overview and Early Results

6. **Tofflemire**, B., Mathieu, R., Herczeg, G., et al. 2018, American Astronomical Society Meeting Abstracts, 231, 414.05
An Observational Study of Accretion Dynamics in Short-Period Pre-Main Sequence Binaries

5. **Tofflemire**, B., Mathieu, R., Ardila, D., et al. 2016, American Astronomical Society Meeting Abstracts, 227, 236.06
Accretion and Magnetic Reconnection in the Pre-Main Sequence Binary DQ Tau as Revealed through High-Cadence Optical Photometry

4. **Tofflemire**, B., Mathieu, R., Ardila, D., & Ciardi, D. 2015, American Astronomical Society Meeting Abstracts, 225, 348.11
Time-series Photometry of the Pre-Main Sequence Binary V4046 Sgr: Testing the Accretion Stream Theory

3. **Tofflemire**, B., Gosnell, N., & Mathieu, R., 2013, American Astronomical Society Meeting Abstracts, 222, 214.04
WIYN Open Cluster Study: Radial Velocity Membership of the Evolved Population of Open Cluster NGC 6791

2. **Tofflemire**, B., Lazarian, A., & Burkhart, B., 2011, Bulletin of the American Astronomical Society, 43, 251.02
Analysis of MHD Interstellar Turbulence using Tsallis Statistics

1. **Tofflemire**, B., Wisniewski, J., Kowalski, A., et al. 2010, Bulletin of the American Astronomical Society, 42, 423.15
M Dwarf Flares: Exoplanet Implications

Astronomer's Telegram

2. Orio, M., **Tofflemire**, B., & Truran, J. 2012, The Astronomer's Telegram, 4092
Chandra X-ray grating observation of Nova LMC 2012

1. **Tofflemire**, B., Orio, M., Kuulkers, E., et al. 2011, The Astronomer's Telegram, 3762
A Chandra grating observation of T Pyxidis

CARMA Memo

1. Wright, M., Pound, M., Plambeck, R., et al. (including **Tofflemire**, B.), 2011, CARMA Summer School 2011, CARMA Memoranda Index #56

References

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