Dr. Rob Zellem (he/him)

# EXOPLANET WATCH

## Inviting Citizen Scientists to Observe Transiting Exoplanets

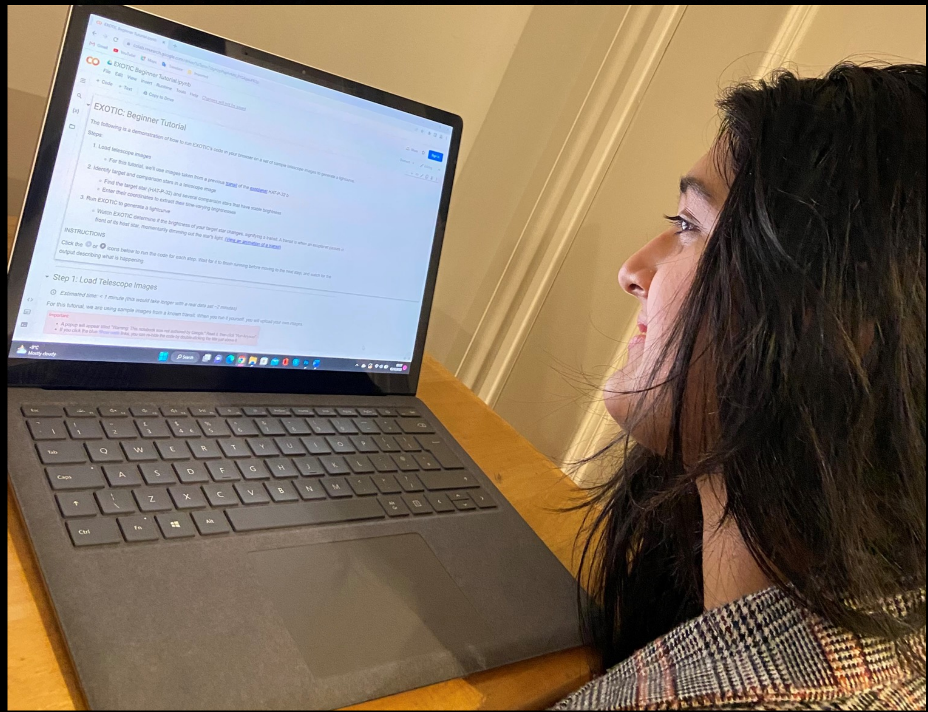


Jet Propulsion Laboratory
California Institute of Technology

# OVERVIEW

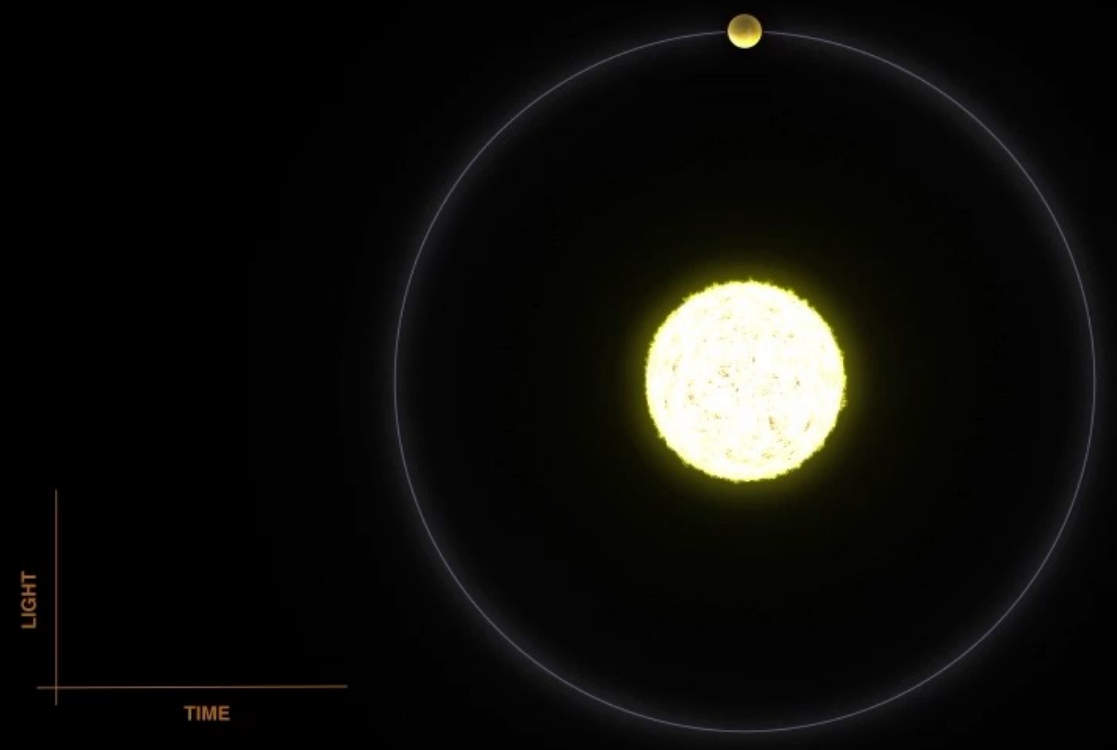
- Announcing the general audience launch of Exoplanet Watch: a citizen science project to monitor transiting exoplanets
    - Limited launch with amateur and professional astronomers since 2021
- Anyone and everyone can participate!
    - Learn how exoplanet science is really done!



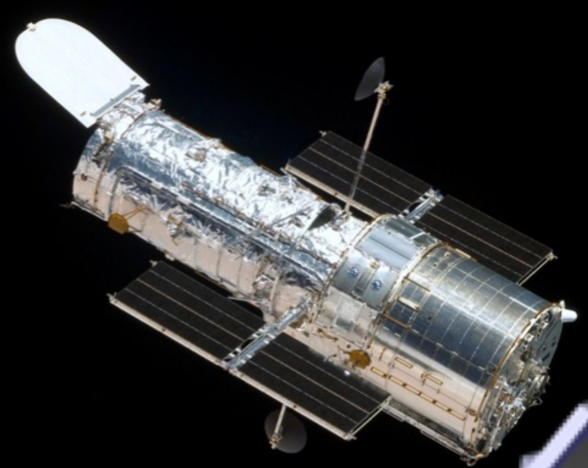


# TRANSITS

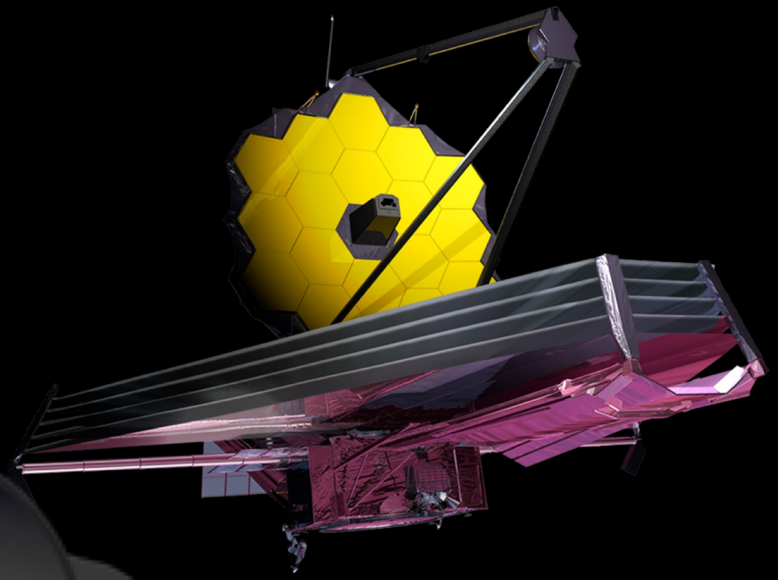
- Measures the change in brightness as the planet passes in front of or behind its host star
- Also allow us to study a planet's atmosphere
  - Exoplanet Watch refines transit times
  - You can help!



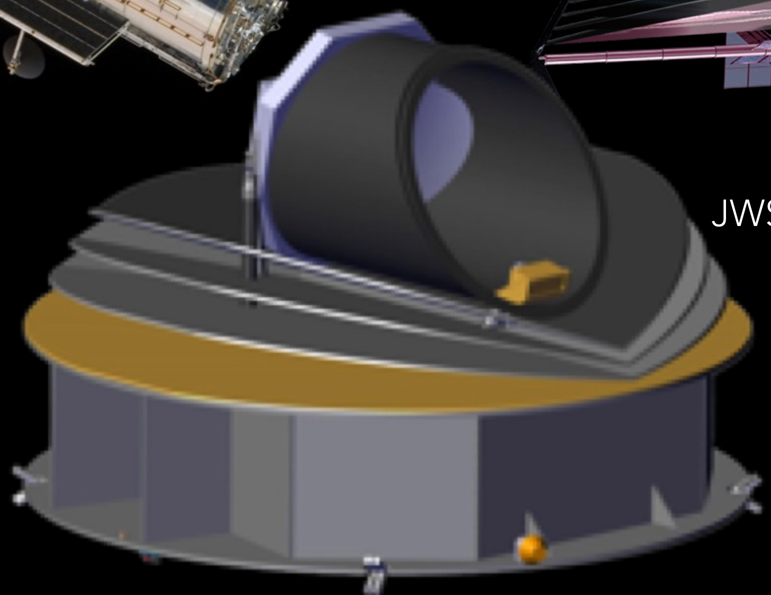

NASA



NASA



JWST - NASA/Goddard



ARIEL
*(artist's concept)*

# EXOPLANET WATCH

CITIZEN SCIENTISTS MONITORING TRANSITING EXOPLANETS

- Citizen science project to routinely observe transiting exoplanets to keep their transit times precise
  - You will help enable NASA science!

# EXOPLANET WATCH

- Collaborative effort to complement existing surveys
- Data is immediately public
- Target requests by professional astronomers
- Observers are listed as co-authors
- Part of NASA's Universe of Learning

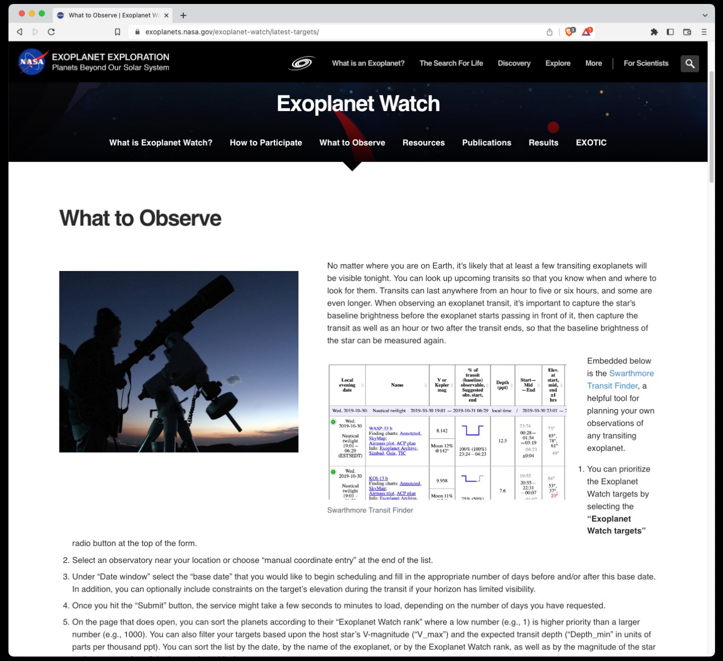
NASA'S UNIVERSE OF LEARNING

# GOALS

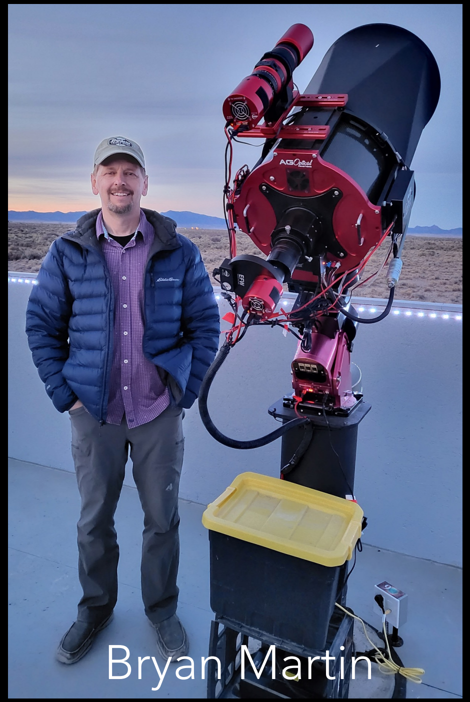
- **Education goals:** to engage and teach the public about exoplanets and enable them to do science
- **Science goals:** to ensure efficient use of large telescopes; discover and confirm new exoplanets; monitor stellar variability

# USER EXPERIENCE

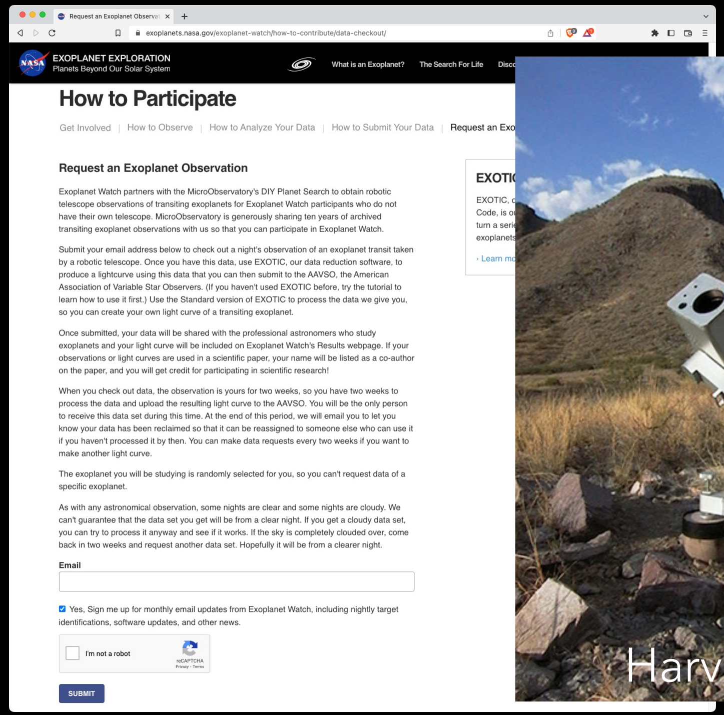
EXOPLANET WATCH




Plan




Observe



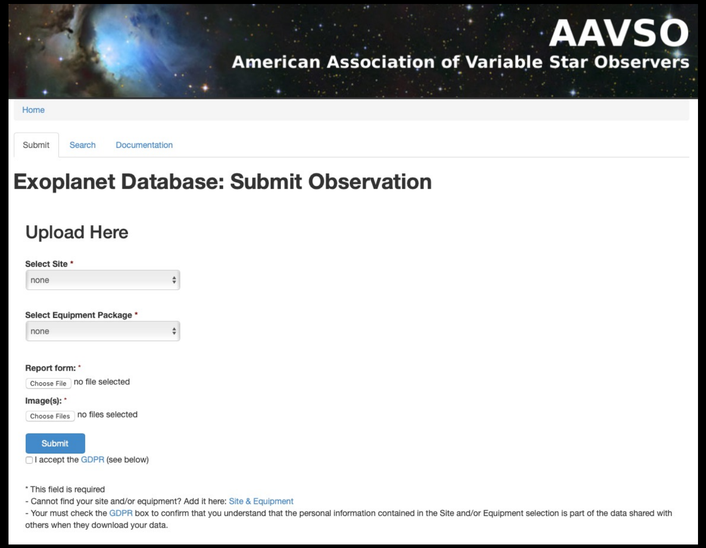


Request Data

EXOTIC

AstroImageJ

Analyze

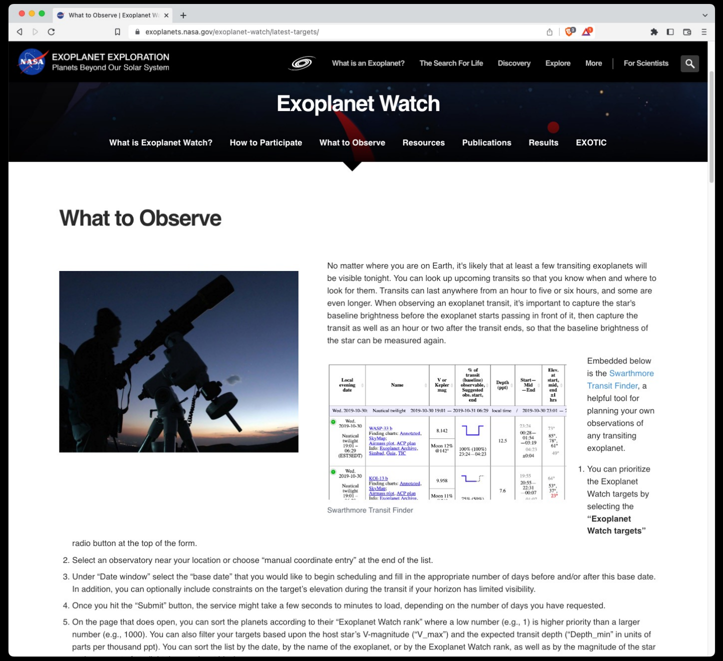



Upload

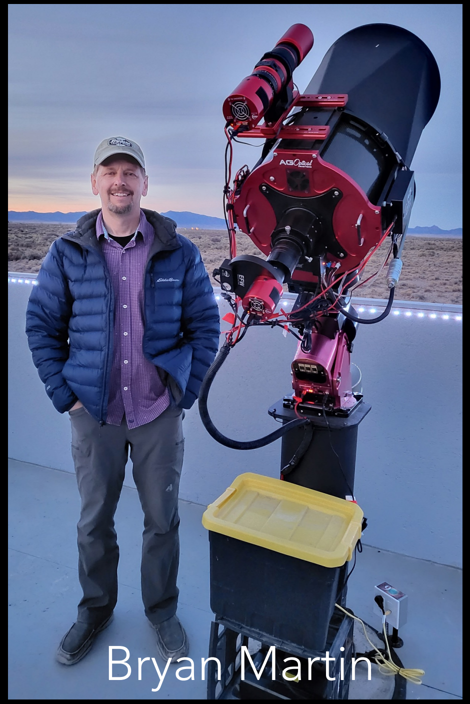

Publish

# USER EXPERIENCE

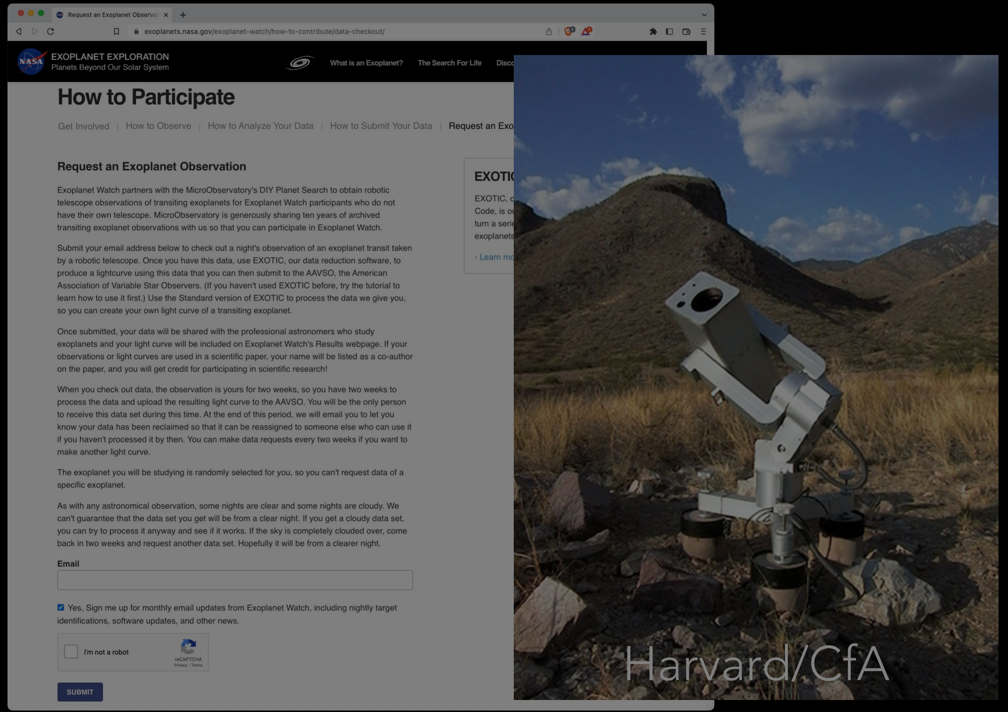
EXOPLANET WATCH




Plan




Observe

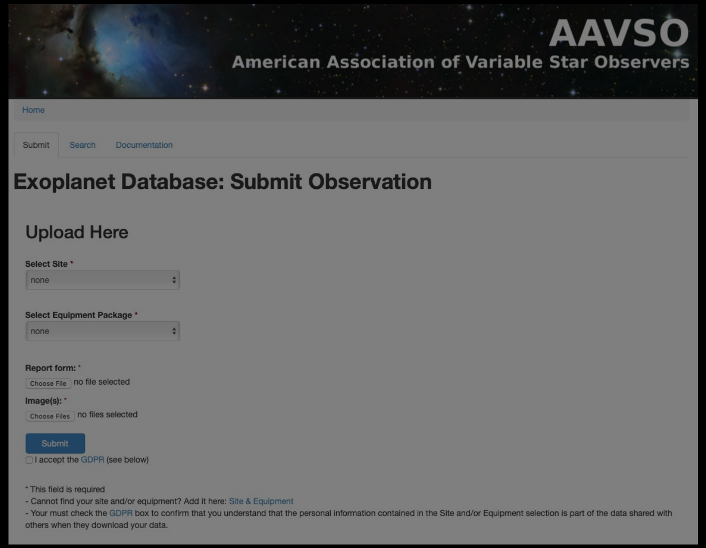



Request Data

EXOTIC

AstroImageJ

Analyze

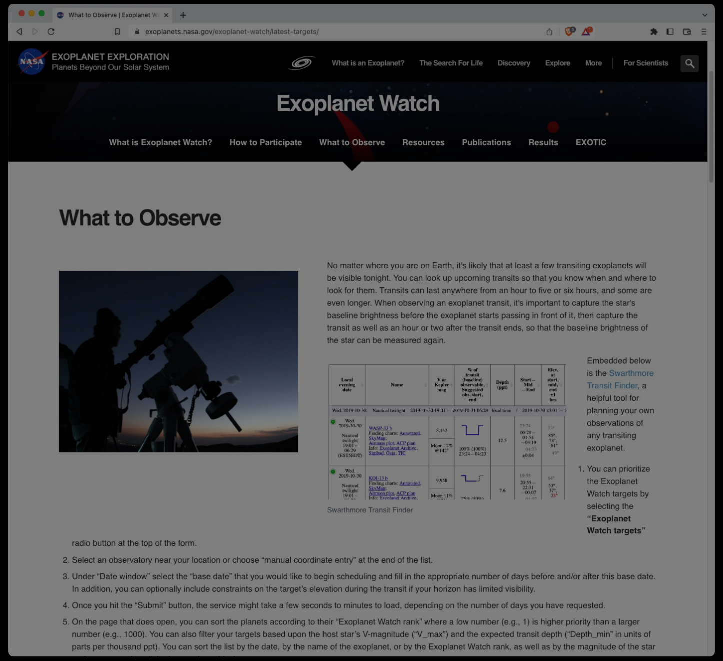



Upload


Publish

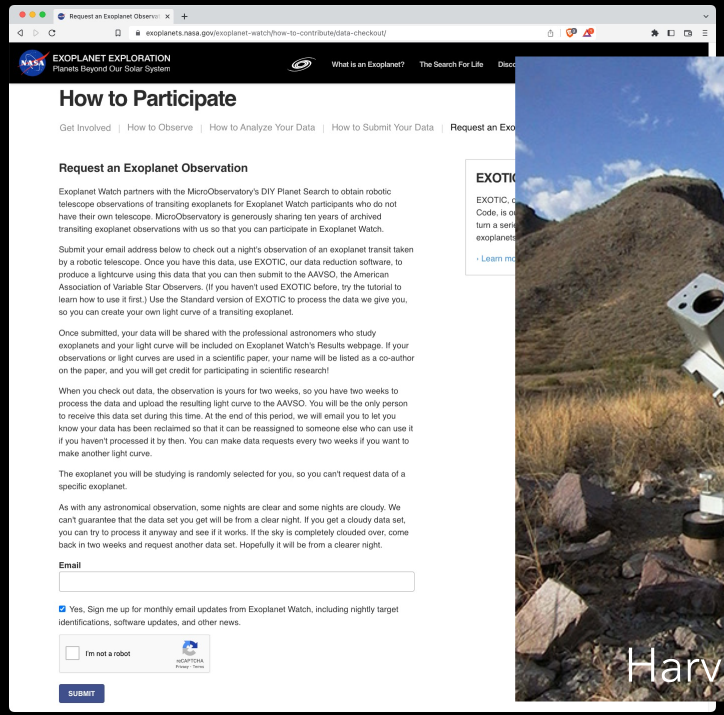
# USER EXPERIENCE

EXOPLANET WATCH




Plan


Observe



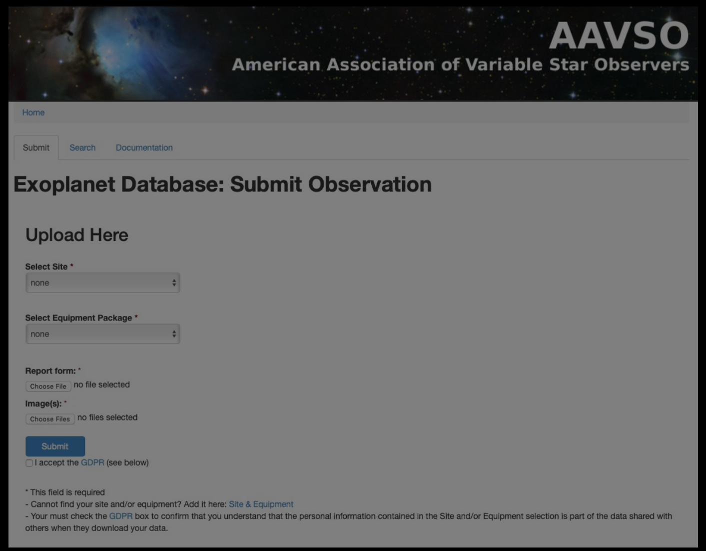


Request Data

EXOTIC

AstroImageJ

Analyze

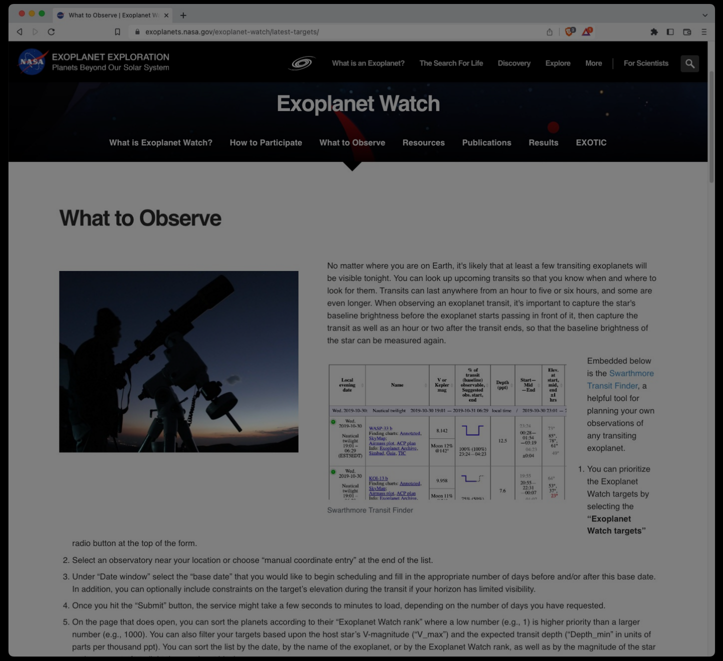



Upload


Publish

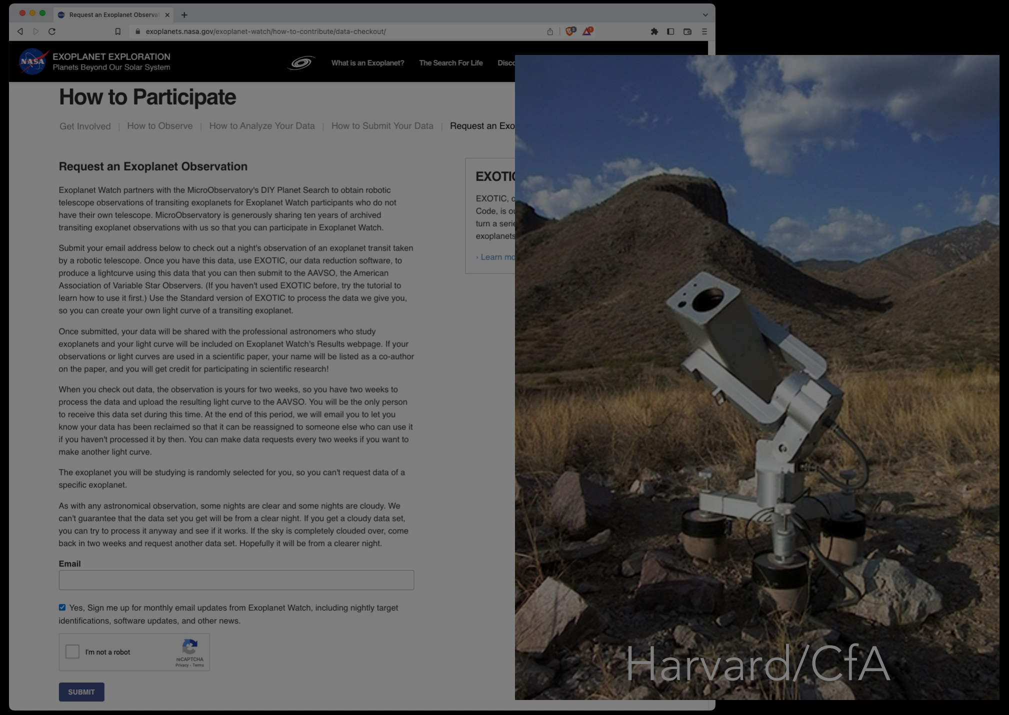
EXOPLANET WATCH

# USER EXPERIENCE




Plan


Observe

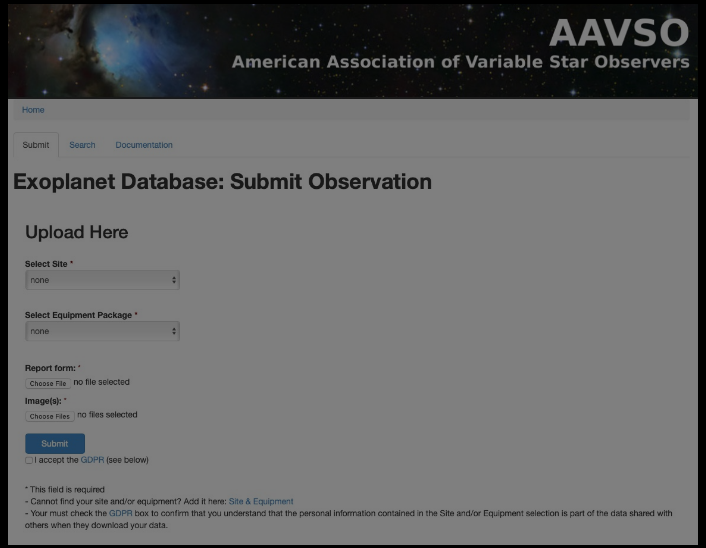



Request Data

EXOTIC

AstroImageJ

Analyze

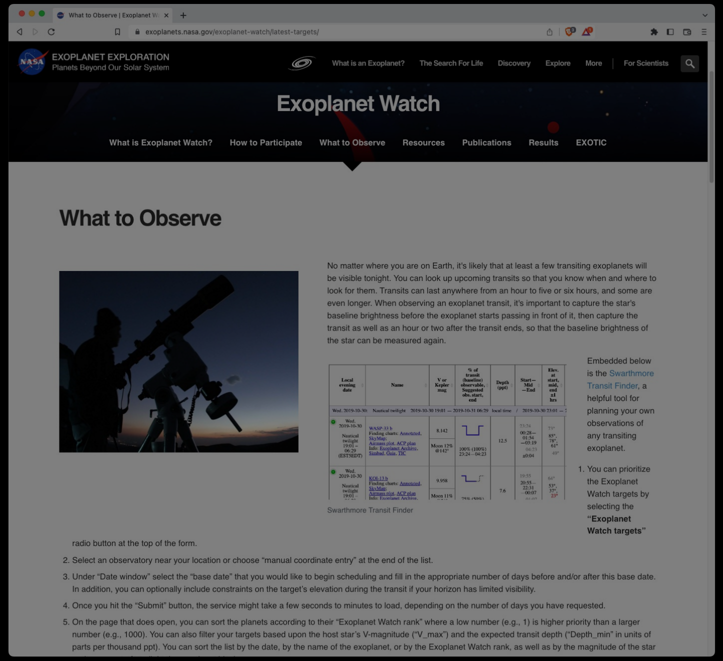



Upload


Publish

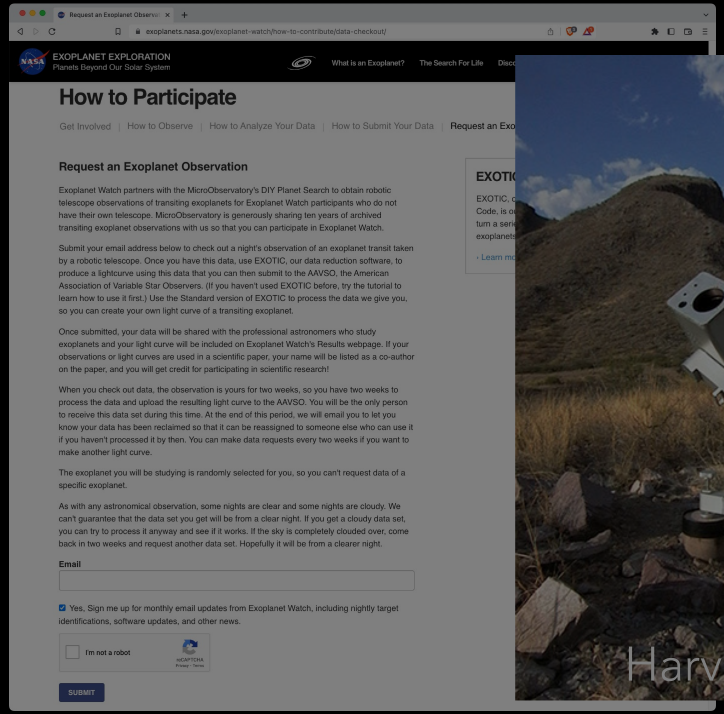
EXOPLANET WATCH

# USER EXPERIENCE




Plan


Observe



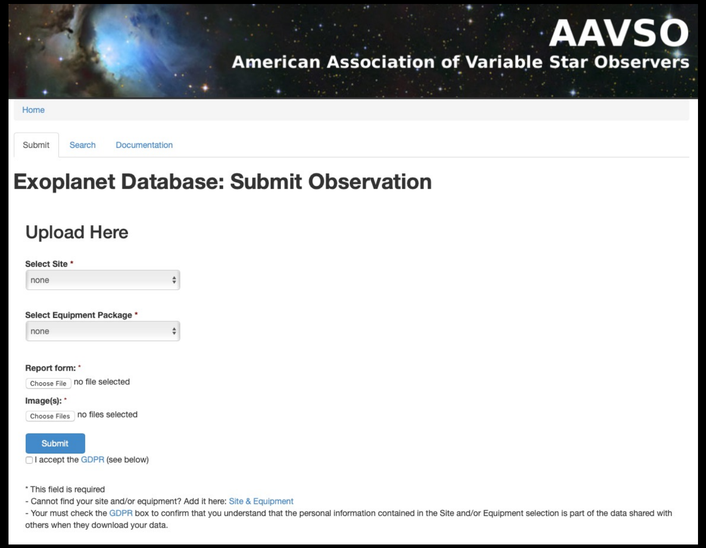


Request Data

EXOTIC

AstroImageJ

Analyze

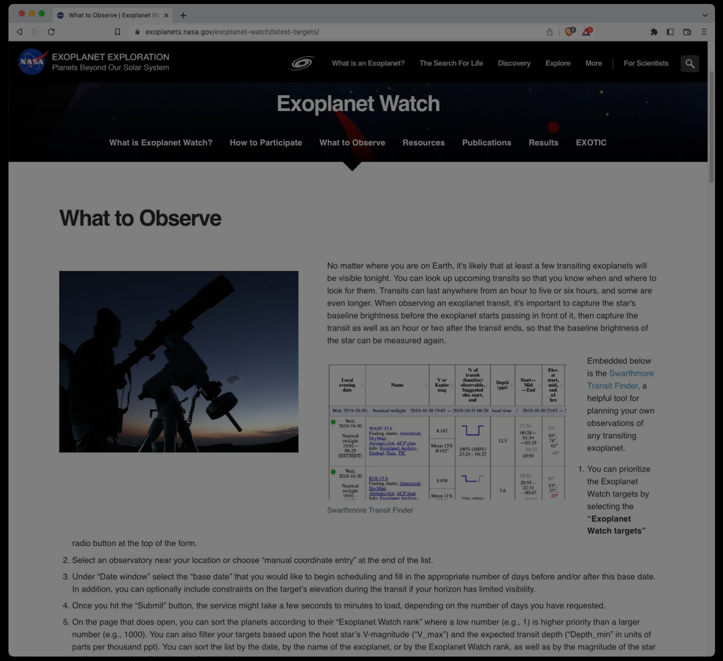



Upload


Publish

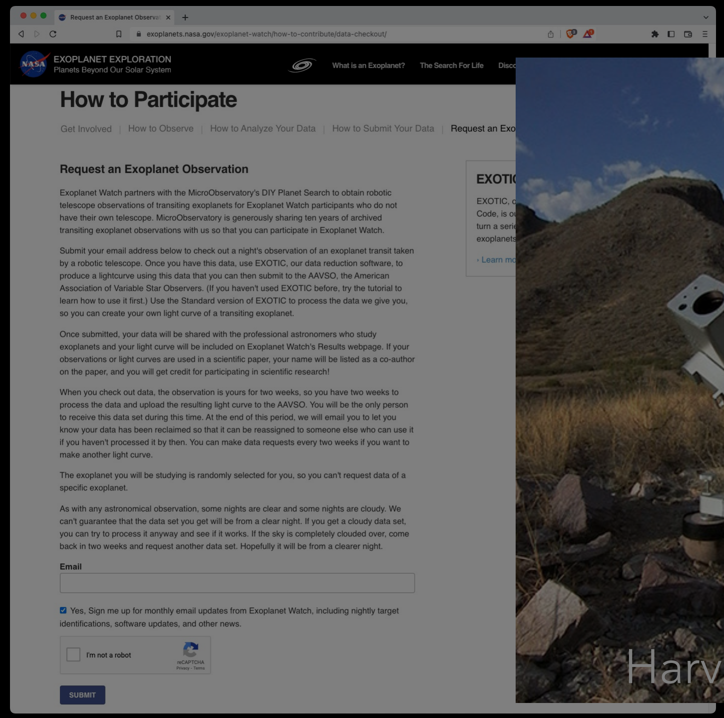
# USER EXPERIENCE

EXOPLANET WATCH




Plan


Observe



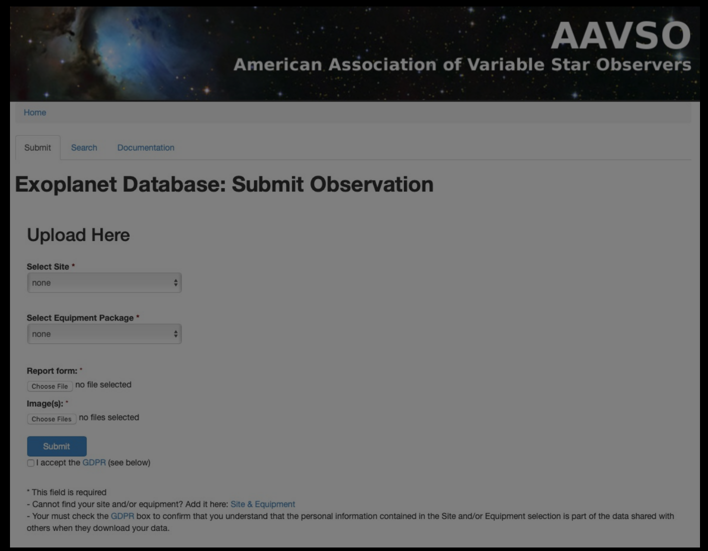


Request Data

EXOTIC

AstroImageJ

Analyze




Upload

Publications of the Astronomical Society of the Pacific, 132:054401 (22pp), 2020 May
https://doi.org/10.1088/1538-3873/ab7ee7


CrossMark

## Utilizing Small Telescopes Operated by Citizen Scientists for Transiting Exoplanet Follow-up

Robert T. Zellem[1], Kyle A. Pearson[1,2], Ethan Blaser[1,3], Martin Fowler[4], David R. Ciardi[5], Anya Biferno[1], Bob Massey[6], Franck Marchis[7,8], Robert Baer[9,10], Conley Ball[11], Mike Chasin[12,13], Mike Conley[10], Scott Dixon[12,13], Elizabeth Fletcher[14], Saneyda Hernandez[14], Sujay Nair[15], Quinn Perian[15], Frank Sienkiewicz[16], Kalée Tock[15], Vivek Vijayakumar[12], Mark R. Swain[1], Gael M. Roudier[1], Geoffrey Bryden[1], Dennis M. Conti[6], Dolores H. Hill[2], Carl W. Hergenrother[2], Mary Dussault[16], Stephen R. Kane[17], Michael Fitzgerald[18], Pat Boyce[12], Laura Peticolas[19], Wilfred Gee[20], Lynn Cominsky[19], Rachel Zimmerman-Brachman[1], Denise Smith[21], Michelle J. Creech-Eakman[22], John Engelke[1,23], Alexandra Iturralde[1,24], Diana Dragomir[25,26,29], Nemanja Jovanovic[27], Brandon Lawton[21], Emmanuel Arbouch[8], Marc Kuchner[28], and Arnaud Malvache[8]

[1] Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, USA; rzellem@jpl.nasa.gov
[2] Lunar and Planetary Laboratory, University of Arizona, 1629 E University Blvd, Tucson, AZ 85721, USA
[3] University of Virginia, Charlottesville, VA 22904, USA
[4] Citizen Scientist, Les Rocquettes, Orchard Road, South Wonston, Winchester SO21 3EX, UK
[5] NASA Exoplanet Science Institute/California Institute of Technology, MC 314-6, 1200 E California Blvd, Pasadena, CA 91125, USA
[6] American Association of Variable Star Observers, 49 Bay State Rd, Cambridge, MA 02138, USA
[7] SETI Institute, 189 Bernardo Ave, Suite 200, Mountain View, CA 94043, USA
[8] Unistellar, 19 rue Vacon, F-13001 Marseille, France
[9] Southern Illinois University Carbondale, MC 4401, 1245 Lincoln Dr, Carbondale, IL 62901, USA
[10] Citizen CATE Experiment, USA
[11] Laguna Blanca School, 4125 Paloma Dr, Santa Barbara, CA 93110, USA
[12] Boyce Research Initiatives and Education Foundation, USA
[13] San Diego Astronomy Association, USA
[14] Towson University, 8000 York Rd, Towson, MD 21252, USA
[15] Stanford Online High School, 415 Broadway Academy Hall, Floor 2, 8853, Redwood City, CA 94063, USA
[16] The Center for Astrophysics, Harvard & Smithsonian, 60 Garden Street, Cambridge, MA 02138, USA
[17] Department of Earth and Planetary Sciences, University of California, Riverside, CA 92521, USA
[18] Edith Cowan University, 270 Joondalup Drive, Joondalup, WA 6027, Australia
[19] Sonoma State University, 1801 East Cotati Ave, Rohnert Park, CA 94928, USA
[20] Macquarie University, Sydney, New South Wales 2109, Australia
[21] Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA
[22] Department of Physics, New Mexico Institute of Mining and Technology, 801 Leroy Place, Socorro, NM 87801, USA
[23] Raytheon Intelligence, Information, and Services, 300 N Lake Ave, Suite 1120, Pasadena, CA 91101, USA
[24] The University of New Mexico, Albuquerque, NM 87131, USA
[25] Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA 02139, USA
[26] Department of Physics and Astronomy, University of New Mexico, Albuquerque, NM, USA
[27] California Institute of Technology, 1200 East California Boulevard, Pasadena, CA 91125, USA
[28] NASA Goddard Space Flight Center, 8800 Greenbelt Rd, Greenbelt, MD 20771, USA

*Received 2019 September 26; accepted 2020 March 11; published 2020 April 8*

**Abstract**

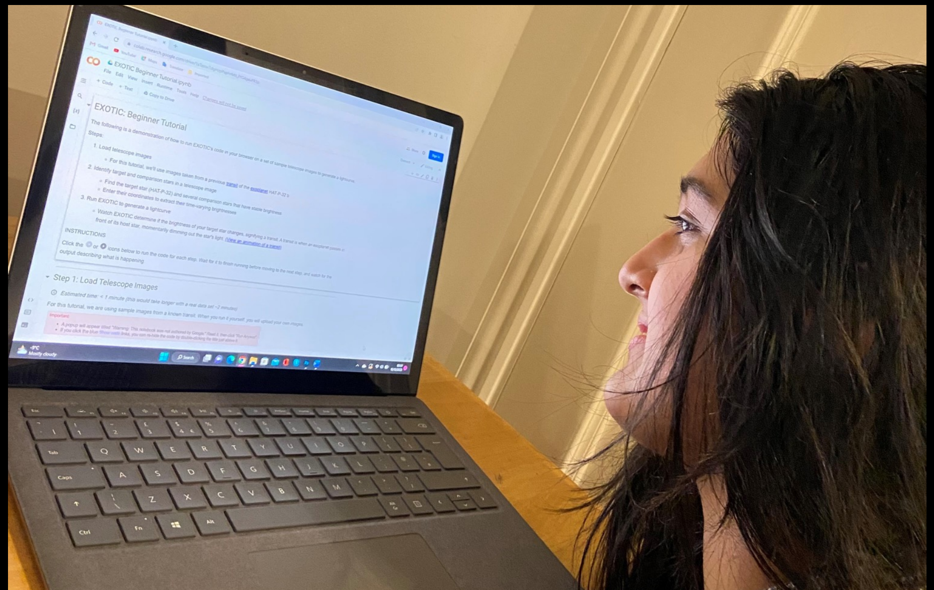
Due to the efforts by numerous ground-based surveys and NASA's Kepler and Transiting Exoplanet Survey Satellite (TESS), there will be hundreds, if not thousands, of transiting exoplanets ideal for atmospheric characterization via spectroscopy with large platforms such as James Webb Space Telescope and ARIEL. However their next predicted mid-transit time could become so increasingly uncertain over time that significant overhead would be required to ensure the detection of the entire transit. As a result, follow-up observations to characterize these exoplanetary atmospheres would require less-efficient use of an observatory's time—which is an issue for large platforms where minimizing observing overheads is a necessity. Here we demonstrate the power of citizen scientists operating smaller observatories ($\leqslant$1 m) to keep ephemerides "fresh," defined here as when the $1\sigma$ uncertainty in the mid-transit time is less than half the transit duration. We advocate for the creation of a community-wide effort to perform ephemeris maintenance on transiting exoplanets by citizen scientists. Such observations can be conducted with even a 6 inch telescope, which has the potential to save up to ~10,000 days for a 1000-planet survey. Based on a preliminary analysis of 14 transits from a single 6 inch MicroObservatory telescope, we empirically estimate the ability of small telescopes to benefit the community. Observations with a

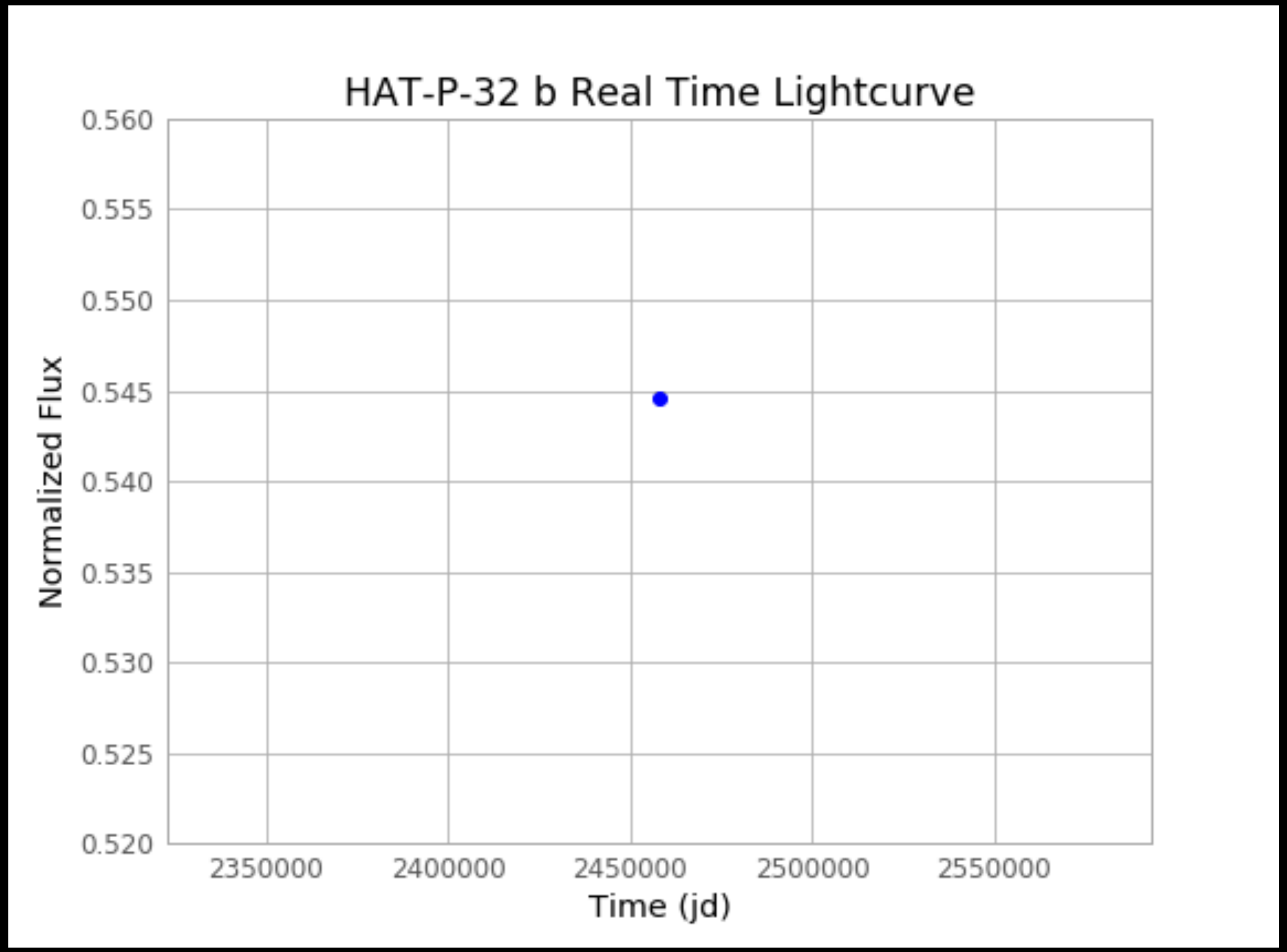
[29] NASA Hubble Fellow.

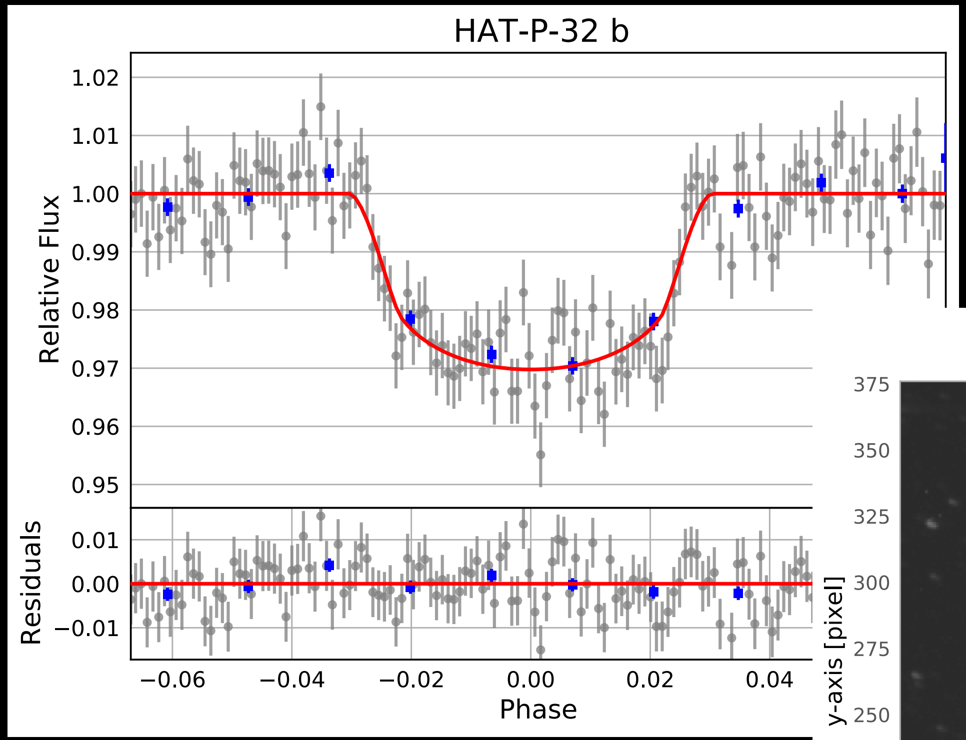
1

Publish

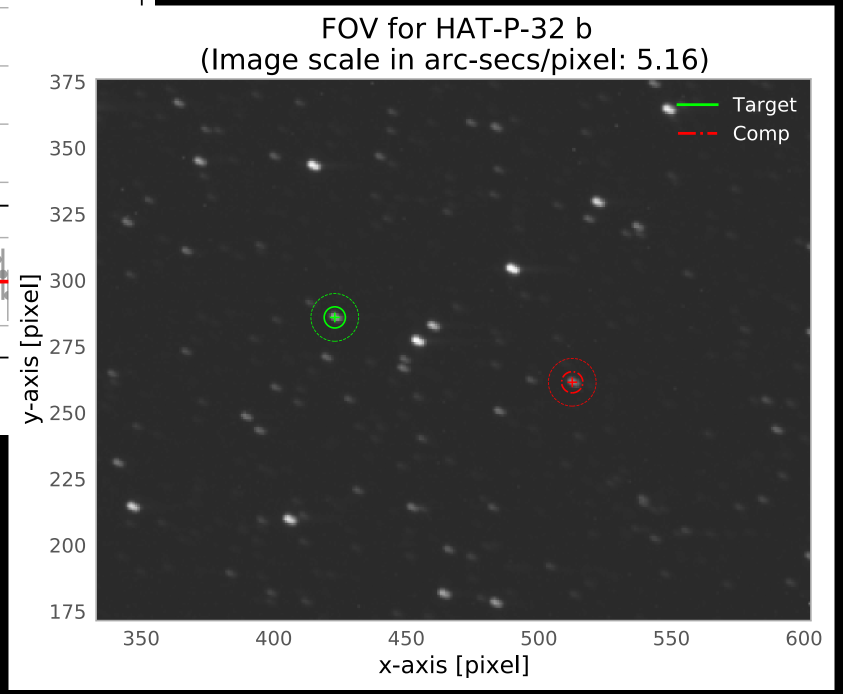
- EXOplanet Transit Interpretation Code
- Real astronomy analysis tool
- Teach you how science is done
- Have step-by-step tutorials on how to use



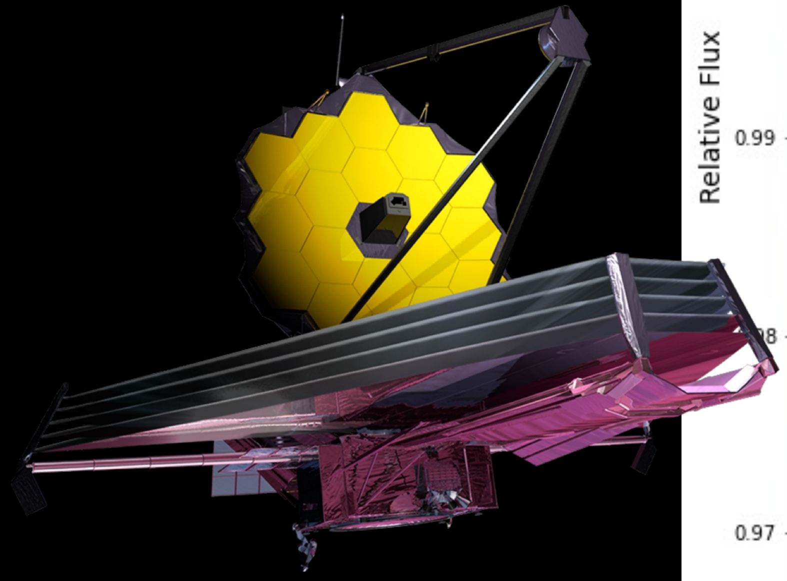


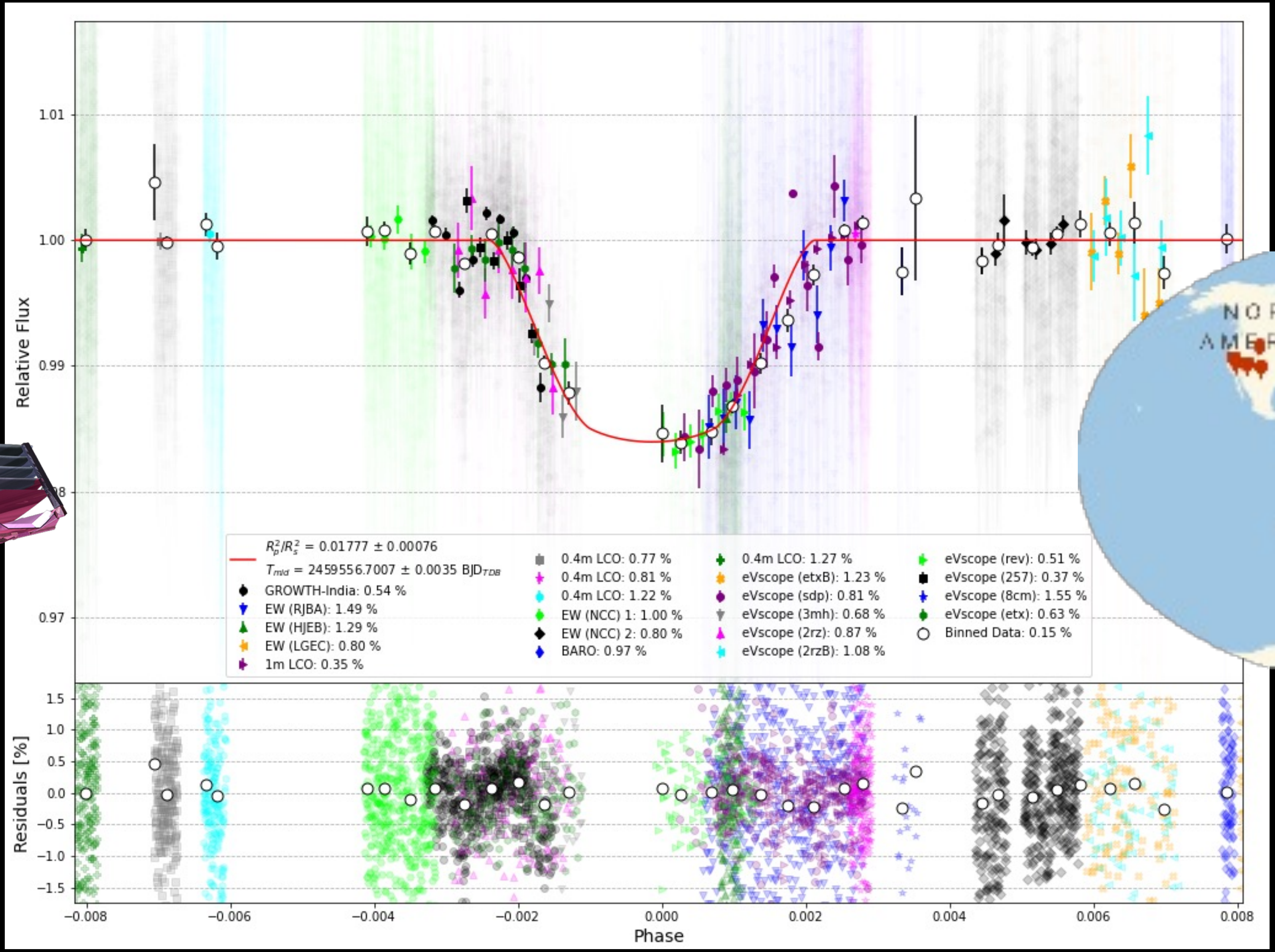

Zellem et al. 2020



# DEC 2021 OBSERVING CAMPAIGN



JWST - NASA/Goddard





24 facilities; <=0.7-m (30-in)

Pearson et al. (2022)

# EXOPLANET WATCH

Get started here:
exoplanets.nasa.gov/exoplanet-watch

Exoplanet Watch Workshop
Jan 18, 2023, 4 PM EST

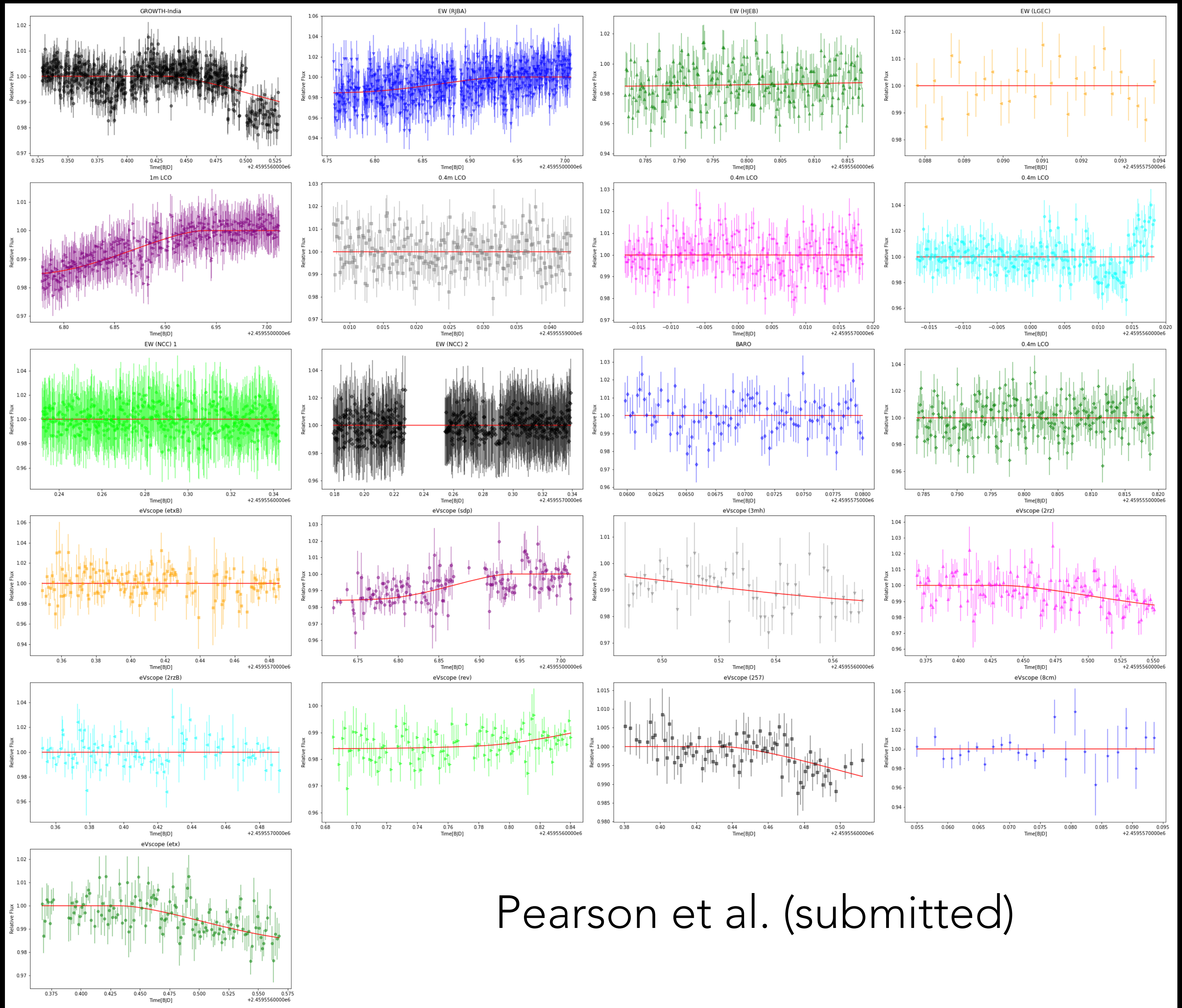
# DEC 2021 OBSERVING CAMPAIGN

- World-wide observing campaign of HD 80606b
  - In support of JWST observations this ~fall
  - 12-hour long transit
  - Requires multiple observers across the world


Pearson et al. (submitted)

# DEC 2021 OBSERVING CAMPAIGN

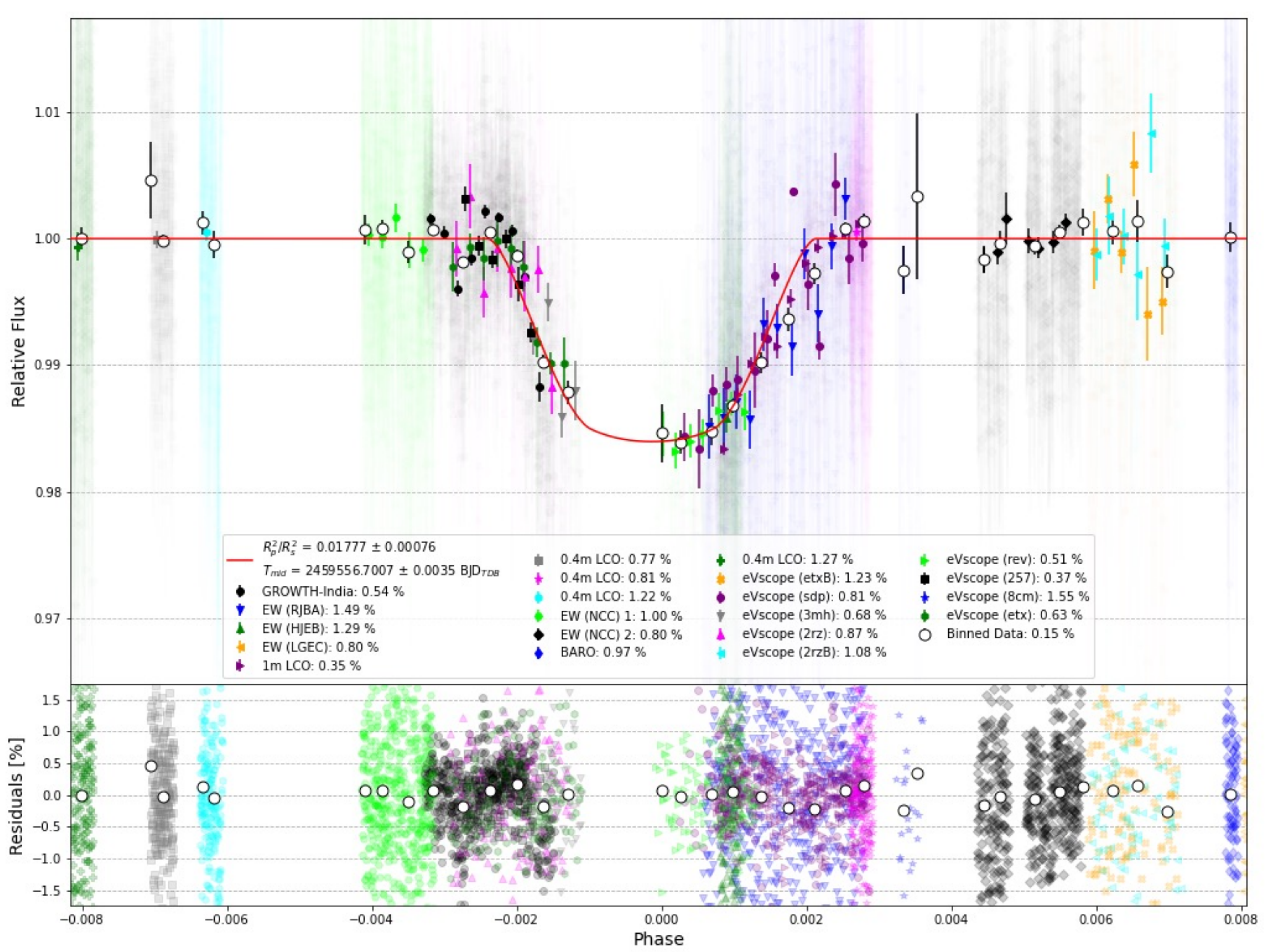
| Facility | Location (N,E) | Size (m) |
|---|---|---|
| Transiting Exoplanet Survey Satellite (TESS) | Space | 0.1 |
| Exoplanet Watch [HJEB] | (30.7, -104.2) | 0.4 |
| Las Cumbres (LCO) | (30.7, -104.2) | 0.4 |
| Las Cumbres (LCO) | (30.7, -104.2) | 0.4 |
| Las Cumbres (LCO) | (30.7, -104.2) | 0.4 |
| Exoplanet Watch [NCC] | (23.5, 120.9) | 0.4 |
| Unistellar eVscope 2 (2rz) | (49.2, -0.4) | 0.11 |
| Unistellar eVscope (etx) | (49.2, -0.4) | 0.11 |
| Unistellar eVscope (257) | (60.8, 24.4) | 0.11 |
| Unistellar eVscope (3mh) | (45.3, 11.1) | 0.11 |
| Exoplanet Watch [GDAI] | (39.0, -108.2) | 0.4 |
| Unistellar eVscope (rev) | (30.4, 97.8) | 0.11 |
| Unistellar eVscope (sdp) | (32.2, -111) | 0.11 |
| GROWTH-India | (32.8, 79.0) | 0.7 |
| Exoplanet Watch [RJBA] | (34.1, -118.1) | 0.15 |
| Las Cumbres (LCO) | (30.7, -104.2) | 1 |
| Exoplanet Watch [HJEB] | (30.7, -104.2) | 0.4 |
| Las Cumbres (LCO) | (30.7, -104.2) | 0.4 |
| Unistellar eVscope (8cm) | (35.1, 134.4) | 0.11 |
| Exoplanet Watch [NCC] | (23.5, 120.9) | 0.4 |
| Unistellar eVscope 2 (2rzB) | (49.2, -0.4) | 0.11 |
| Unistellar eVscope (etxB) | (49.2, -0.4) | 0.11 |
| Boyce-Astro Research Observatory (BARO) | (32.6, -116.3) | 0.43 |
| Exoplanet Watch [LGEC] | (28.3, -16.6) | 0.4 |
| Exoplanet Watch [FMAA] | (31.7, -111.1) | 0.15 |




Pearson et al. (submitted)

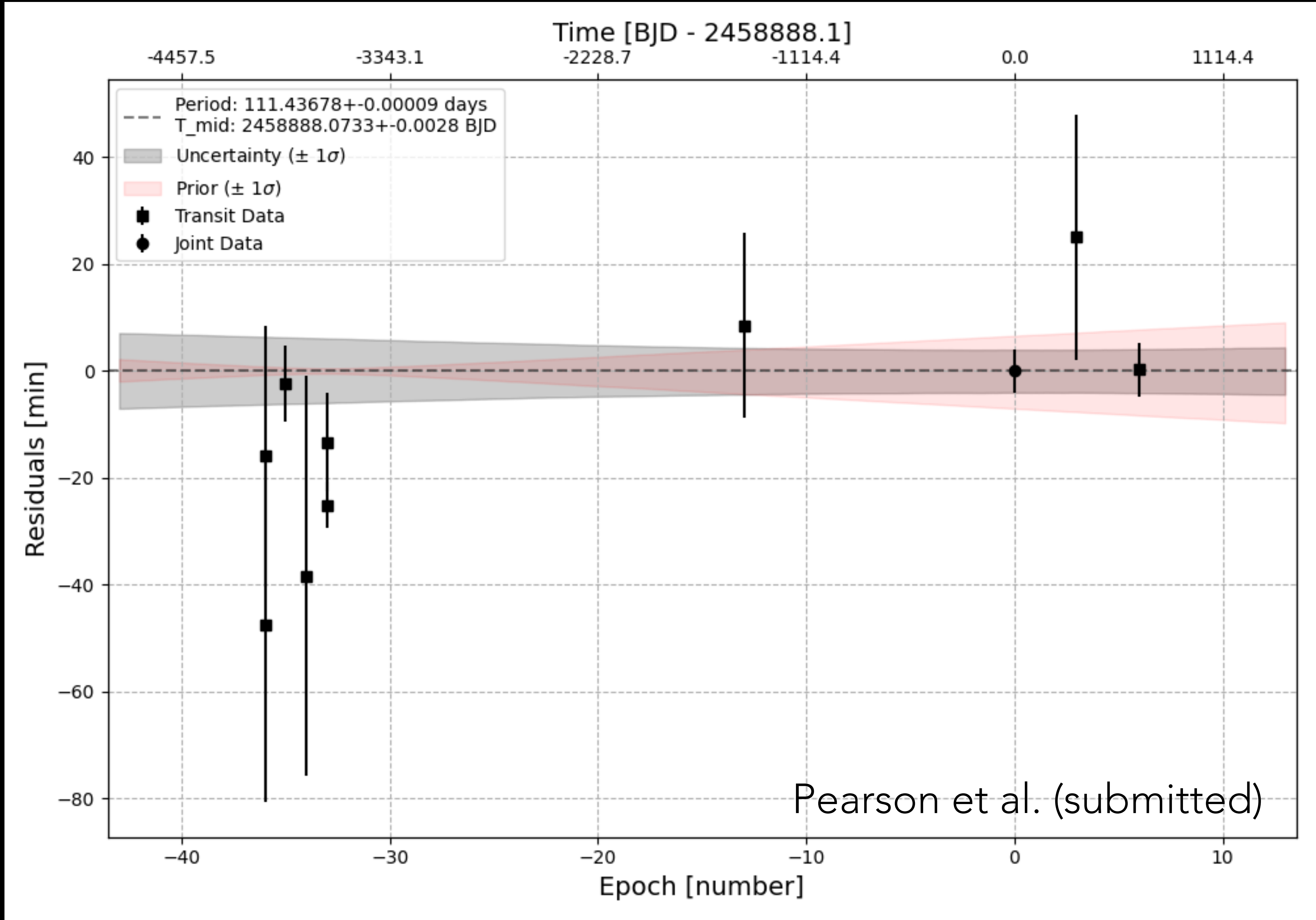
24 facilities; <=0.7-m (30-in)

# DEC 2021 OBSERVING CAMPAIGN

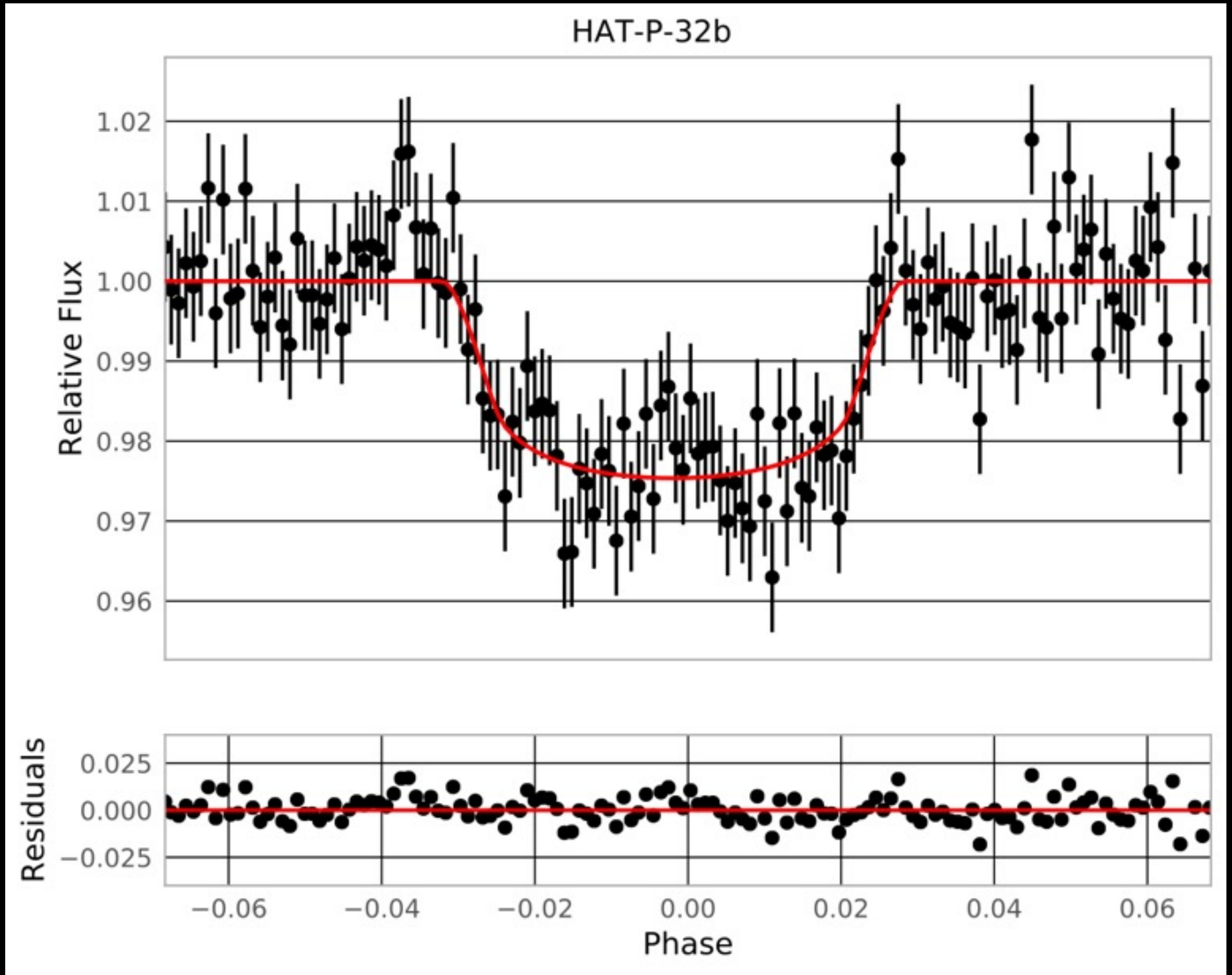



Pearson et al. (submitted)

# DEC 2021 OBSERVING CAMPAIGN

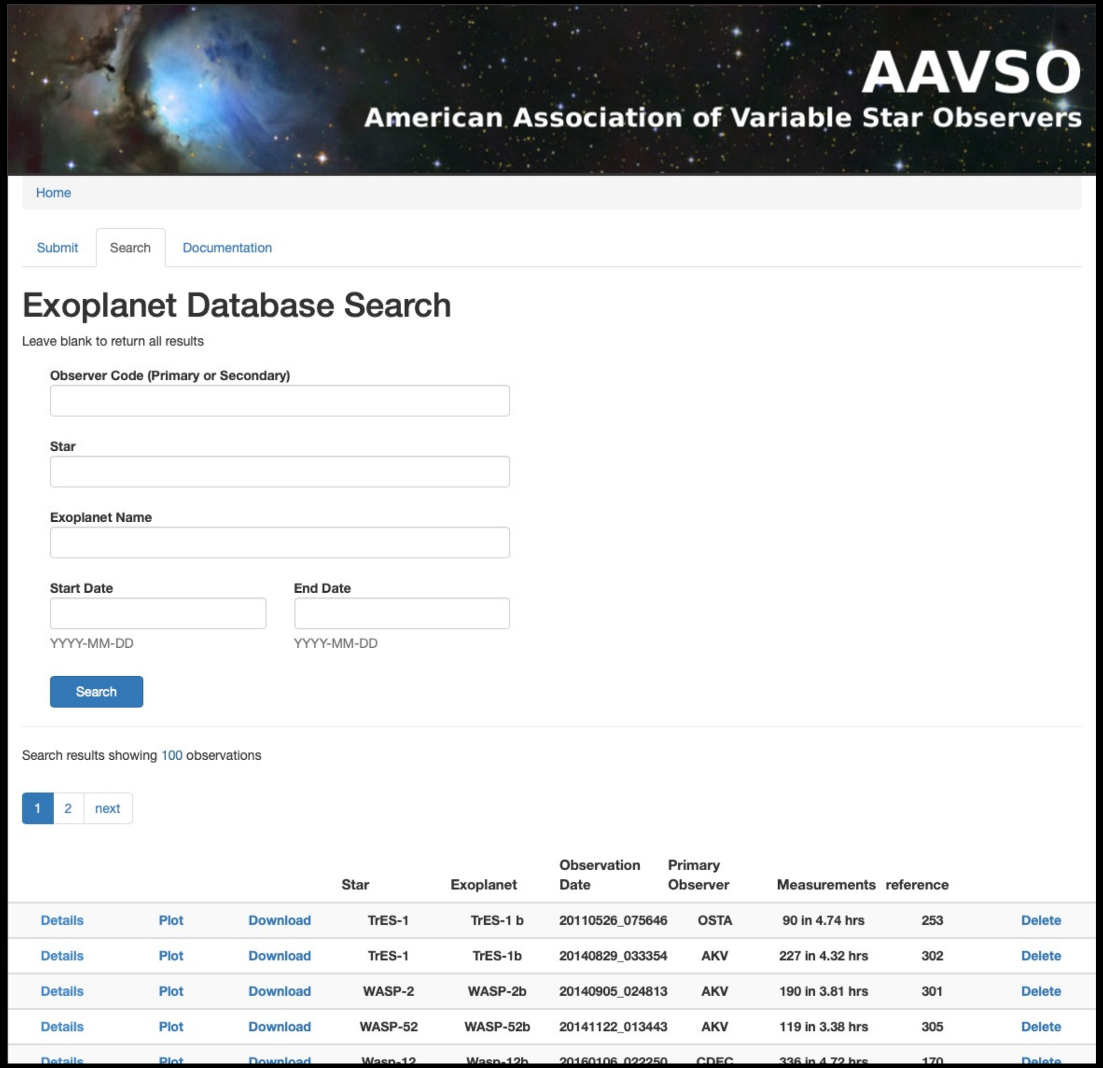


# MICROOBSERVATORY DATA



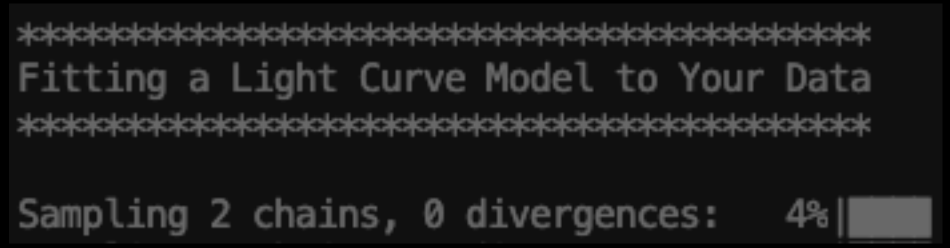

Zellem et al. (2020)

# CITISENS PIPELINE



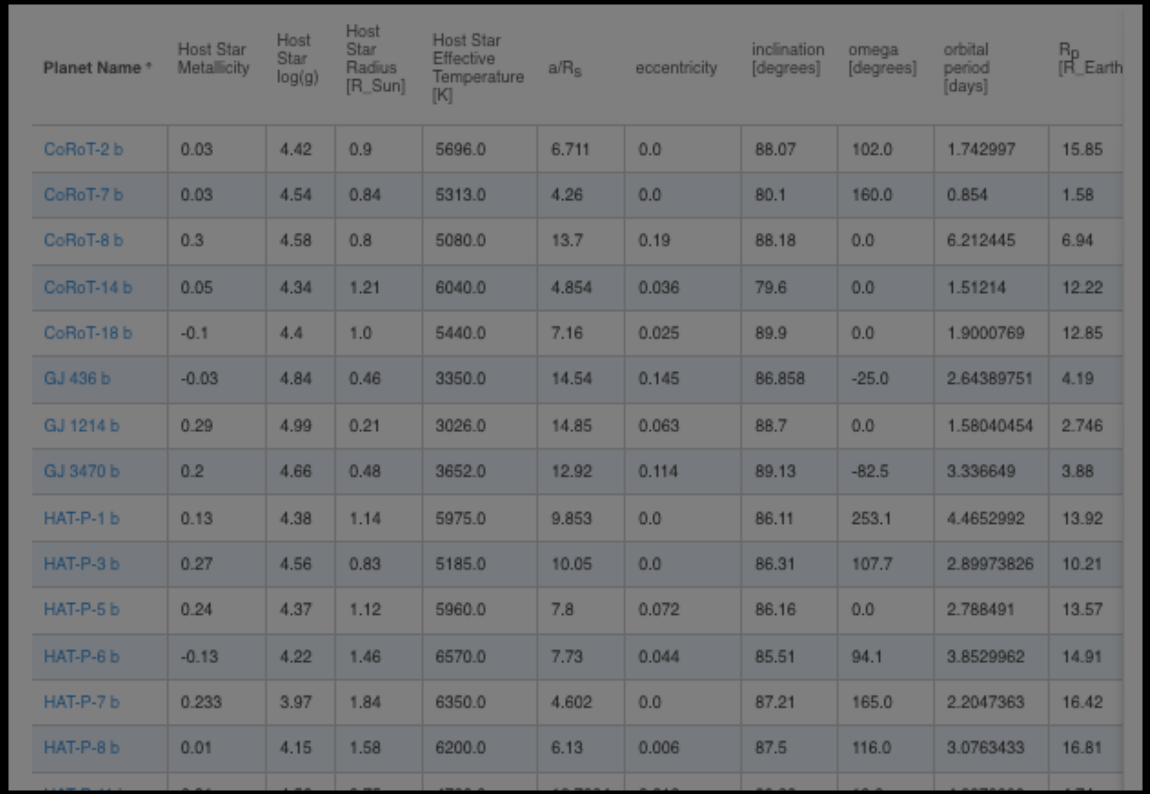

| | | | Star | Exoplanet | Observation Date | Primary Observer | Measurements | reference | |
|---|---|---|---|---|---|---|---|---|---|
| Details | Plot | Download | TrES-1 | TrES-1 b | 20110526_075646 | OSTA | 90 in 4.74 hrs | 253 | Delete |
| Details | Plot | Download | TrES-1 | TrES-1b | 20140829_033354 | AKV | 227 in 4.32 hrs | 302 | Delete |
| Details | Plot | Download | WASP-2 | WASP-2b | 20140905_024813 | AKV | 190 in 3.81 hrs | 301 | Delete |
| Details | Plot | Download | WASP-52 | WASP-52b | 20141122_013443 | AKV | 119 in 3.38 hrs | 305 | Delete |

1. Scrape




2. Process

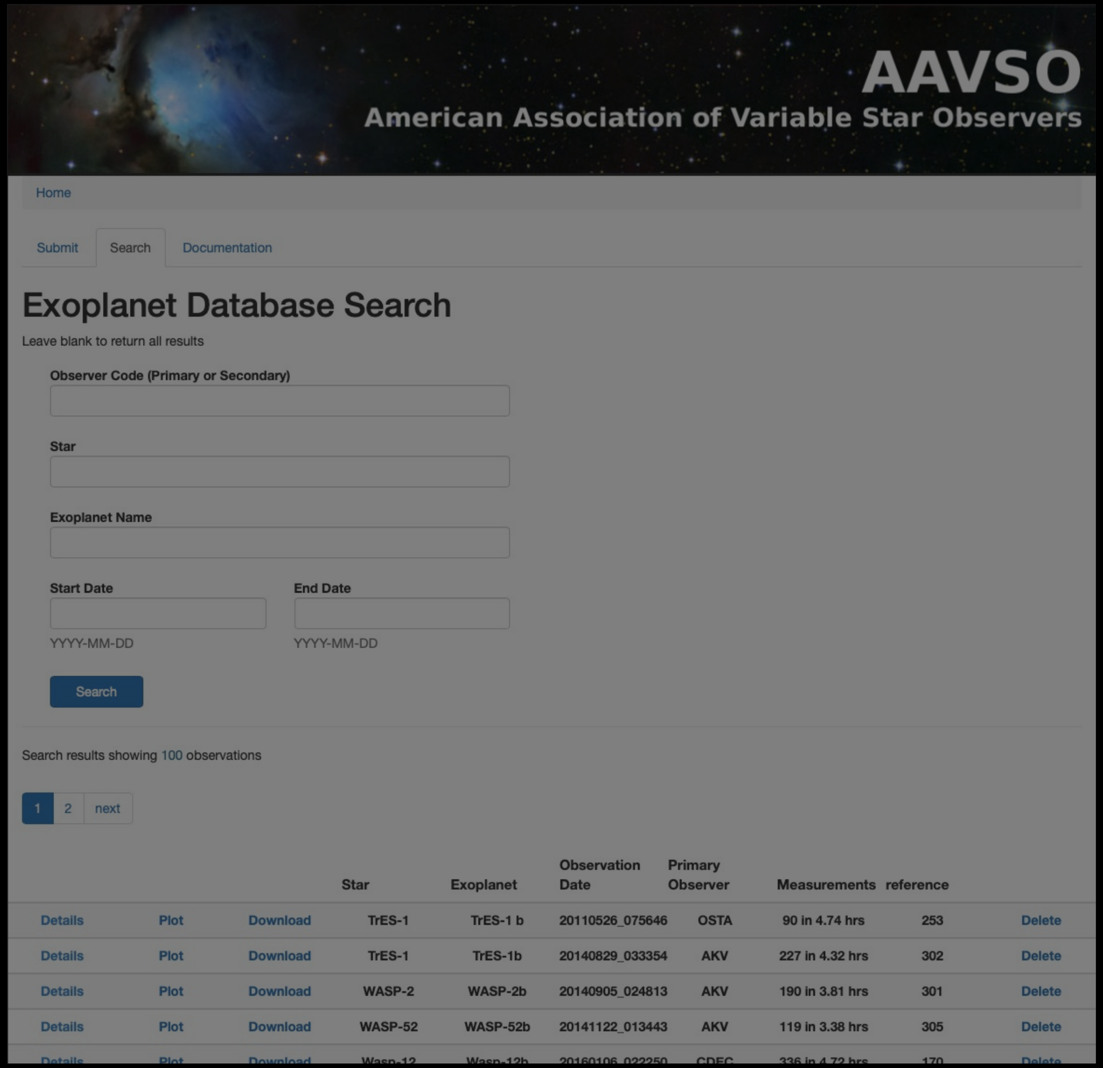
EXOPLANET WATCH



| Planet Name * | Host Star Metallicity | Host Star log(g) | Host Star Radius [R_Sun] | Host Star Effective Temperature [K] | $a/R_s$ | eccentricity | inclination [degrees] | omega [degrees] | orbital period [days] | $R_p$ [R_Earth] |
|---|---|---|---|---|---|---|---|---|---|---|
| CoRoT-2 b | 0.03 | 4.42 | 0.9 | 5696.0 | 6.711 | 0.0 | 88.07 | 102.0 | 1.742997 | 15.85 |
| CoRoT-7 b | 0.03 | 4.54 | 0.84 | 5313.0 | 4.26 | 0.0 | 80.1 | 160.0 | 0.854 | 1.58 |
| CoRoT-8 b | 0.3 | 4.58 | 0.8 | 5080.0 | 13.7 | 0.19 | 88.18 | 0.0 | 6.212445 | 6.94 |
| CoRoT-14 b | 0.05 | 4.34 | 1.21 | 6040.0 | 4.854 | 0.036 | 79.6 | 0.0 | 1.51214 | 12.22 |
| CoRoT-18 b | -0.1 | 4.4 | 1.0 | 5440.0 | 7.16 | 0.025 | 89.9 | 0.0 | 1.9000769 | 12.85 |
| GJ 436 b | -0.03 | 4.84 | 0.46 | 3350.0 | 14.54 | 0.145 | 86.858 | -25.0 | 2.64389751 | 4.19 |
| GJ 1214 b | 0.29 | 4.99 | 0.21 | 3026.0 | 14.85 | 0.063 | 88.7 | 0.0 | 1.58040454 | 2.746 |
| GJ 3470 b | 0.2 | 4.66 | 0.48 | 3652.0 | 12.92 | 0.114 | 89.13 | -82.5 | 3.336649 | 3.88 |
| HAT-P-1 b | 0.13 | 4.38 | 1.14 | 5975.0 | 9.853 | 0.0 | 86.11 | 253.1 | 4.4652992 | 13.92 |
| HAT-P-3 b | 0.27 | 4.56 | 0.83 | 5185.0 | 10.05 | 0.0 | 86.31 | 107.7 | 2.89973826 | 10.21 |
| HAT-P-5 b | 0.24 | 4.37 | 1.12 | 5960.0 | 7.8 | 0.072 | 86.16 | 0.0 | 2.788491 | 13.57 |
| HAT-P-6 b | -0.13 | 4.22 | 1.46 | 6570.0 | 7.73 | 0.044 | 85.51 | 94.1 | 3.8529962 | 14.91 |
| HAT-P-7 b | 0.233 | 3.97 | 1.84 | 6350.0 | 4.602 | 0.0 | 87.21 | 165.0 | 2.2047363 | 16.42 |
| HAT-P-8 b | 0.01 | 4.15 | 1.58 | 6200.0 | 6.13 | 0.006 | 87.5 | 116.0 | 3.0763433 | 16.81 |

3. Publish

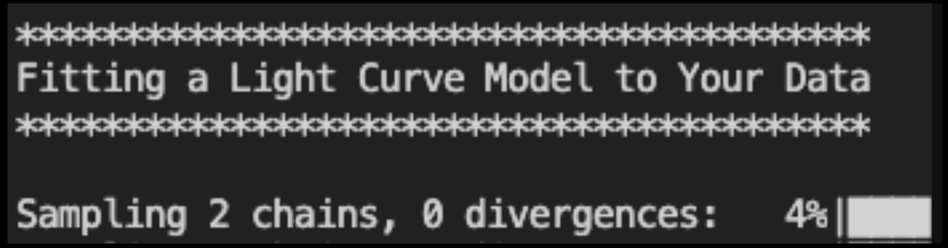
# CITISENS PIPELINE





| | | | Star | Exoplanet | Observation Date | Primary Observer | Measurements | reference | |
|---|---|---|---|---|---|---|---|---|---|
| Details | Plot | Download | TrES-1 | TrES-1 b | 20110526_075646 | OSTA | 90 in 4.74 hrs | 253 | Delete |
| Details | Plot | Download | TrES-1 | TrES-1b | 20140829_033354 | AKV | 227 in 4.32 hrs | 302 | Delete |
| Details | Plot | Download | WASP-2 | WASP-2b | 20140905_024813 | AKV | 190 in 3.81 hrs | 301 | Delete |
| Details | Plot | Download | WASP-52 | WASP-52b | 20141122_013443 | AKV | 119 in 3.38 hrs | 305 | Delete |

1. Scrape

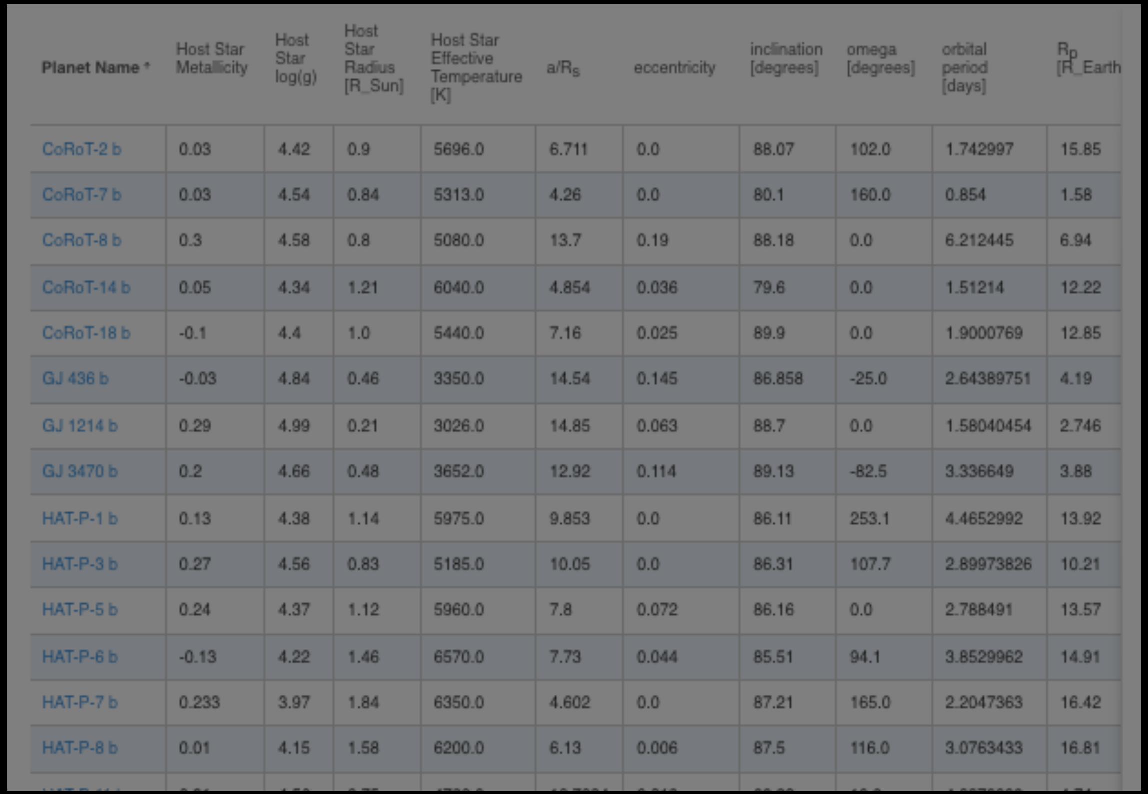


```
****************************************
Fitting a Light Curve Model to Your Data
****************************************

Sampling 2 chains, 0 divergences:   4%|
```

2. Process

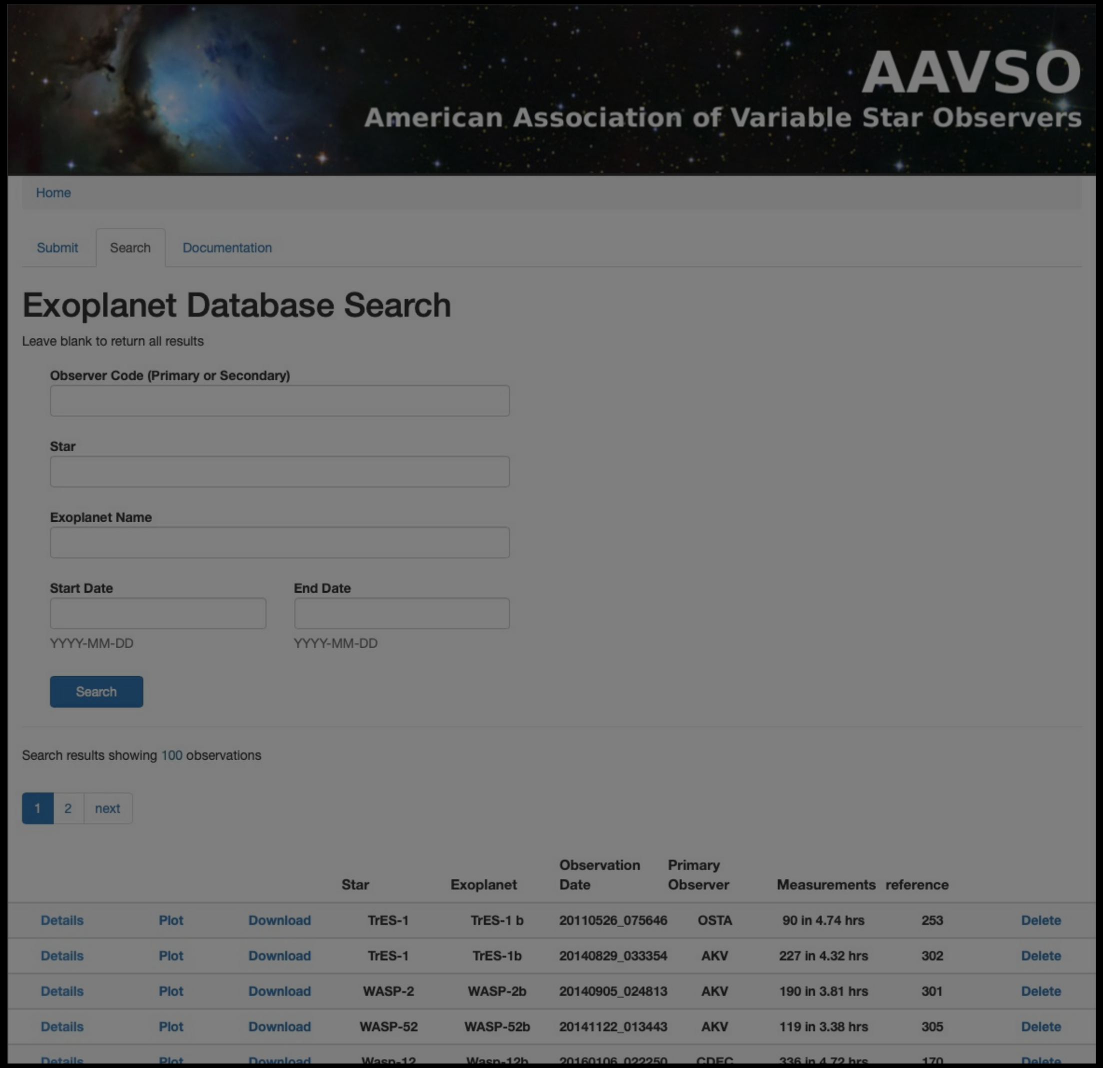
EXOPLANET WATCH



| Planet Name * | Host Star Metallicity | Host Star log(g) | Host Star Radius [R_Sun] | Host Star Effective Temperature [K] | $a/R_s$ | eccentricity | inclination [degrees] | omega [degrees] | orbital period [days] | $R_p$ [R_Earth |
|---|---|---|---|---|---|---|---|---|---|---|
| CoRoT-2 b | 0.03 | 4.42 | 0.9 | 5696.0 | 6.711 | 0.0 | 88.07 | 102.0 | 1.742997 | 15.85 |
| CoRoT-7 b | 0.03 | 4.54 | 0.84 | 5313.0 | 4.26 | 0.0 | 80.1 | 160.0 | 0.854 | 1.58 |
| CoRoT-8 b | 0.3 | 4.58 | 0.8 | 5080.0 | 13.7 | 0.19 | 88.18 | 0.0 | 6.212445 | 6.94 |
| CoRoT-14 b | 0.05 | 4.34 | 1.21 | 6040.0 | 4.854 | 0.036 | 79.6 | 0.0 | 1.51214 | 12.22 |
| CoRoT-18 b | -0.1 | 4.4 | 1.0 | 5440.0 | 7.16 | 0.025 | 89.9 | 0.0 | 1.9000769 | 12.85 |
| GJ 436 b | -0.03 | 4.84 | 0.46 | 3350.0 | 14.54 | 0.145 | 86.858 | -25.0 | 2.64389751 | 4.19 |
| GJ 1214 b | 0.29 | 4.99 | 0.21 | 3026.0 | 14.85 | 0.063 | 88.7 | 0.0 | 1.58040454 | 2.746 |
| GJ 3470 b | 0.2 | 4.66 | 0.48 | 3652.0 | 12.92 | 0.114 | 89.13 | -82.5 | 3.336649 | 3.88 |
| HAT-P-1 b | 0.13 | 4.38 | 1.14 | 5975.0 | 9.853 | 0.0 | 86.11 | 253.1 | 4.4652992 | 13.92 |
| HAT-P-3 b | 0.27 | 4.56 | 0.83 | 5185.0 | 10.05 | 0.0 | 86.31 | 107.7 | 2.89973826 | 10.21 |
| HAT-P-5 b | 0.24 | 4.37 | 1.12 | 5960.0 | 7.8 | 0.072 | 86.16 | 0.0 | 2.788491 | 13.57 |
| HAT-P-6 b | -0.13 | 4.22 | 1.46 | 6570.0 | 7.73 | 0.044 | 85.51 | 94.1 | 3.8529962 | 14.91 |
| HAT-P-7 b | 0.233 | 3.97 | 1.84 | 6350.0 | 4.602 | 0.0 | 87.21 | 165.0 | 2.2047363 | 16.42 |
| HAT-P-8 b | 0.01 | 4.15 | 1.58 | 6200.0 | 6.13 | 0.006 | 87.5 | 116.0 | 3.0763433 | 16.81 |

3. Publish

# CITISENS PIPELINE



AAVSO
American Association of Variable Star Observers

Home

Submit | Search | Documentation

## Exoplanet Database Search

Leave blank to return all results

Observer Code (Primary or Secondary)

Star

Exoplanet Name

Start Date | End Date
YYYY-MM-DD | YYYY-MM-DD

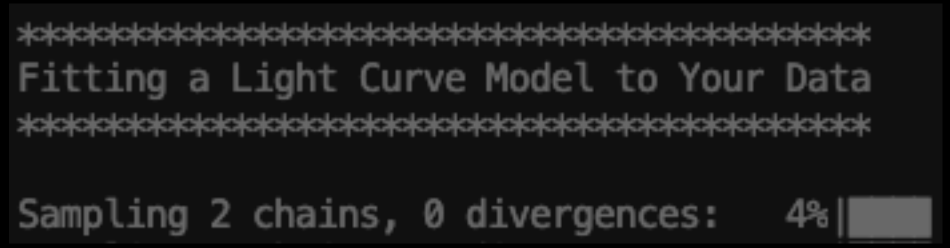
Search

Search results showing 100 observations

1 | 2 | next

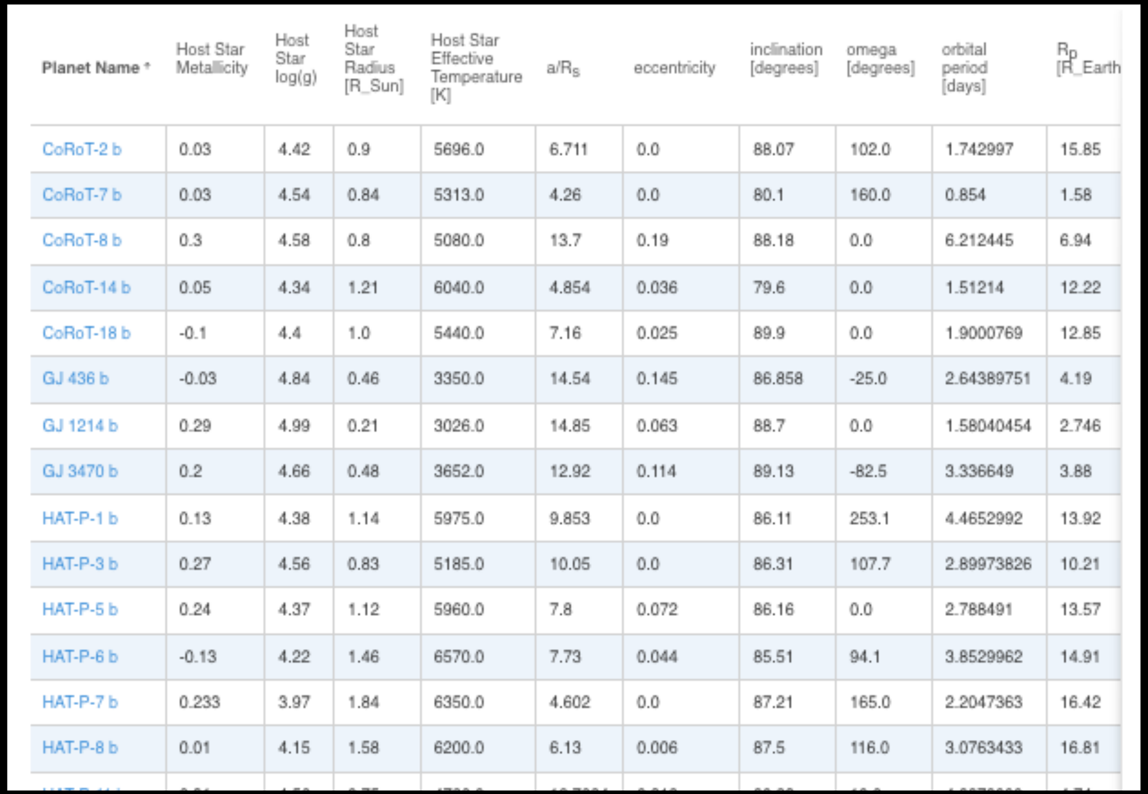
| | | | Star | Exoplanet | Observation Date | Primary Observer | Measurements | reference | |
|---|---|---|---|---|---|---|---|---|---|
| Details | Plot | Download | TrES-1 | TrES-1 b | 20110526_075646 | OSTA | 90 in 4.74 hrs | 253 | Delete |
| Details | Plot | Download | TrES-1 | TrES-1b | 20140829_033354 | AKV | 227 in 4.32 hrs | 302 | Delete |
| Details | Plot | Download | WASP-2 | WASP-2b | 20140905_024813 | AKV | 190 in 3.81 hrs | 301 | Delete |
| Details | Plot | Download | WASP-52 | WASP-52b | 20141122_013443 | AKV | 119 in 3.38 hrs | 305 | Delete |

1. Scrape




2. Process

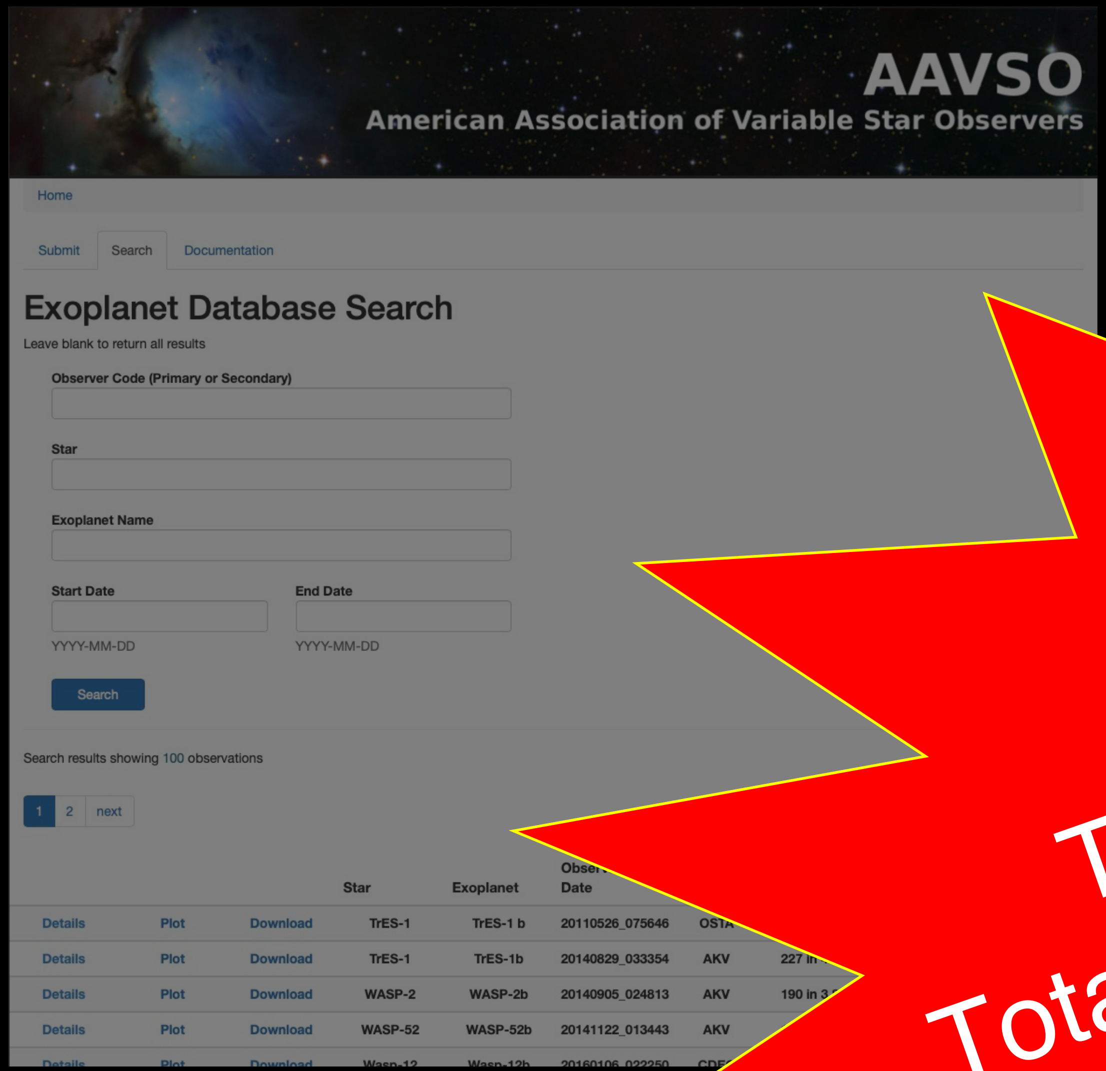
EXOPLANET WATCH



| Planet Name | Host Star Metallicity | Host Star log(g) | Host Star Radius [R_Sun] | Host Star Effective Temperature [K] | $a/R_s$ | eccentricity | inclination [degrees] | omega [degrees] | orbital period [days] | $R_p$ [R_Earth |
|---|---|---|---|---|---|---|---|---|---|---|
| CoRoT-2 b | 0.03 | 4.42 | 0.9 | 5696.0 | 6.711 | 0.0 | 88.07 | 102.0 | 1.742997 | 15.85 |
| CoRoT-7 b | 0.03 | 4.54 | 0.84 | 5313.0 | 4.26 | 0.0 | 80.1 | 160.0 | 0.854 | 1.58 |
| CoRoT-8 b | 0.3 | 4.58 | 0.8 | 5080.0 | 13.7 | 0.19 | 88.18 | 0.0 | 6.212445 | 6.94 |
| CoRoT-14 b | 0.05 | 4.34 | 1.21 | 6040.0 | 4.854 | 0.036 | 79.6 | 0.0 | 1.51214 | 12.22 |
| CoRoT-18 b | -0.1 | 4.4 | 1.0 | 5440.0 | 7.16 | 0.025 | 89.9 | 0.0 | 1.9000769 | 12.85 |
| GJ 436 b | -0.03 | 4.84 | 0.46 | 3350.0 | 14.54 | 0.145 | 86.858 | -25.0 | 2.64389751 | 4.19 |
| GJ 1214 b | 0.29 | 4.99 | 0.21 | 3026.0 | 14.85 | 0.063 | 88.7 | 0.0 | 1.58040454 | 2.746 |
| GJ 3470 b | 0.2 | 4.66 | 0.48 | 3652.0 | 12.92 | 0.114 | 89.13 | -82.5 | 3.336649 | 3.88 |
| HAT-P-1 b | 0.13 | 4.38 | 1.14 | 5975.0 | 9.853 | 0.0 | 86.11 | 253.1 | 4.4652992 | 13.92 |
| HAT-P-3 b | 0.27 | 4.56 | 0.83 | 5185.0 | 10.05 | 0.0 | 86.31 | 107.7 | 2.89973826 | 10.21 |
| HAT-P-5 b | 0.24 | 4.37 | 1.12 | 5960.0 | 7.8 | 0.072 | 86.16 | 0.0 | 2.788491 | 13.57 |
| HAT-P-6 b | -0.13 | 4.22 | 1.46 | 6570.0 | 7.73 | 0.044 | 85.51 | 94.1 | 3.8529962 | 14.91 |
| HAT-P-7 b | 0.233 | 3.97 | 1.84 | 6350.0 | 4.602 | 0.0 | 87.21 | 165.0 | 2.2047363 | 16.42 |
| HAT-P-8 b | 0.01 | 4.15 | 1.58 | 6200.0 | 6.13 | 0.006 | 87.5 | 116.0 | 3.0763433 | 16.81 |

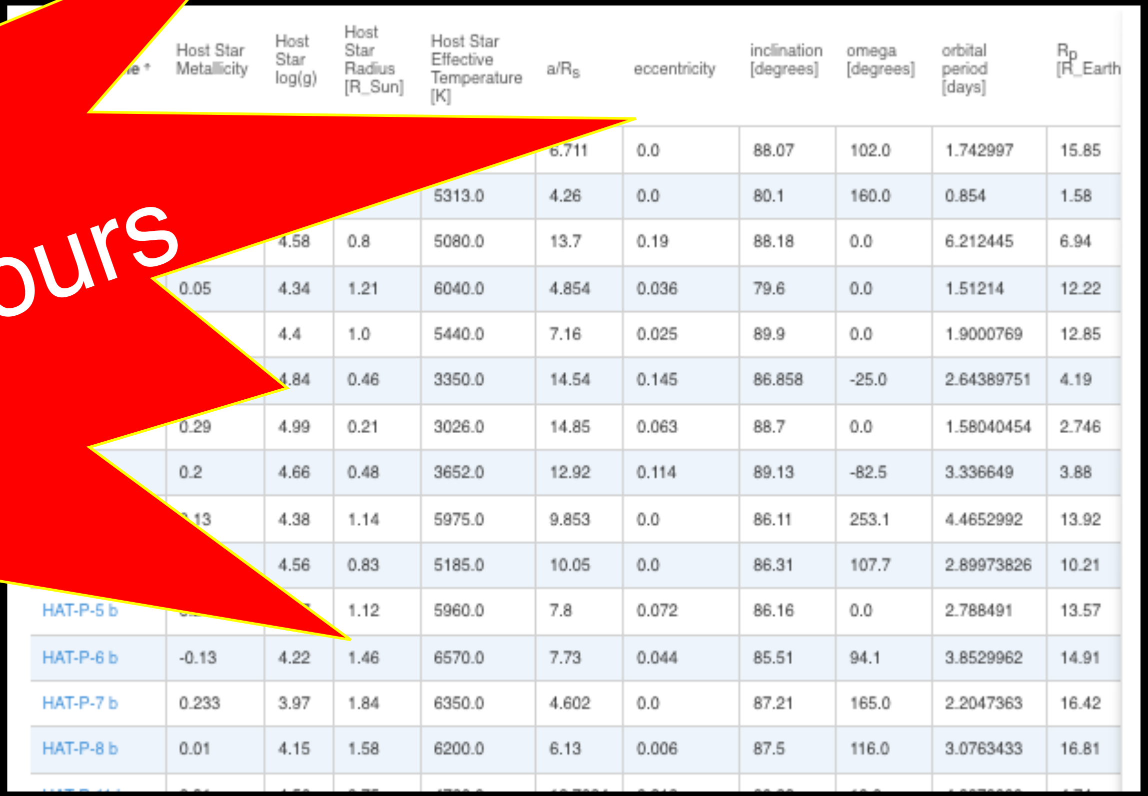
3. Publish

# CITISENS PIPELINE




Total Targets: 264
Total Reductions: 1289
Total Time Saved: 0.333 hours

EXOPLANET WATCH



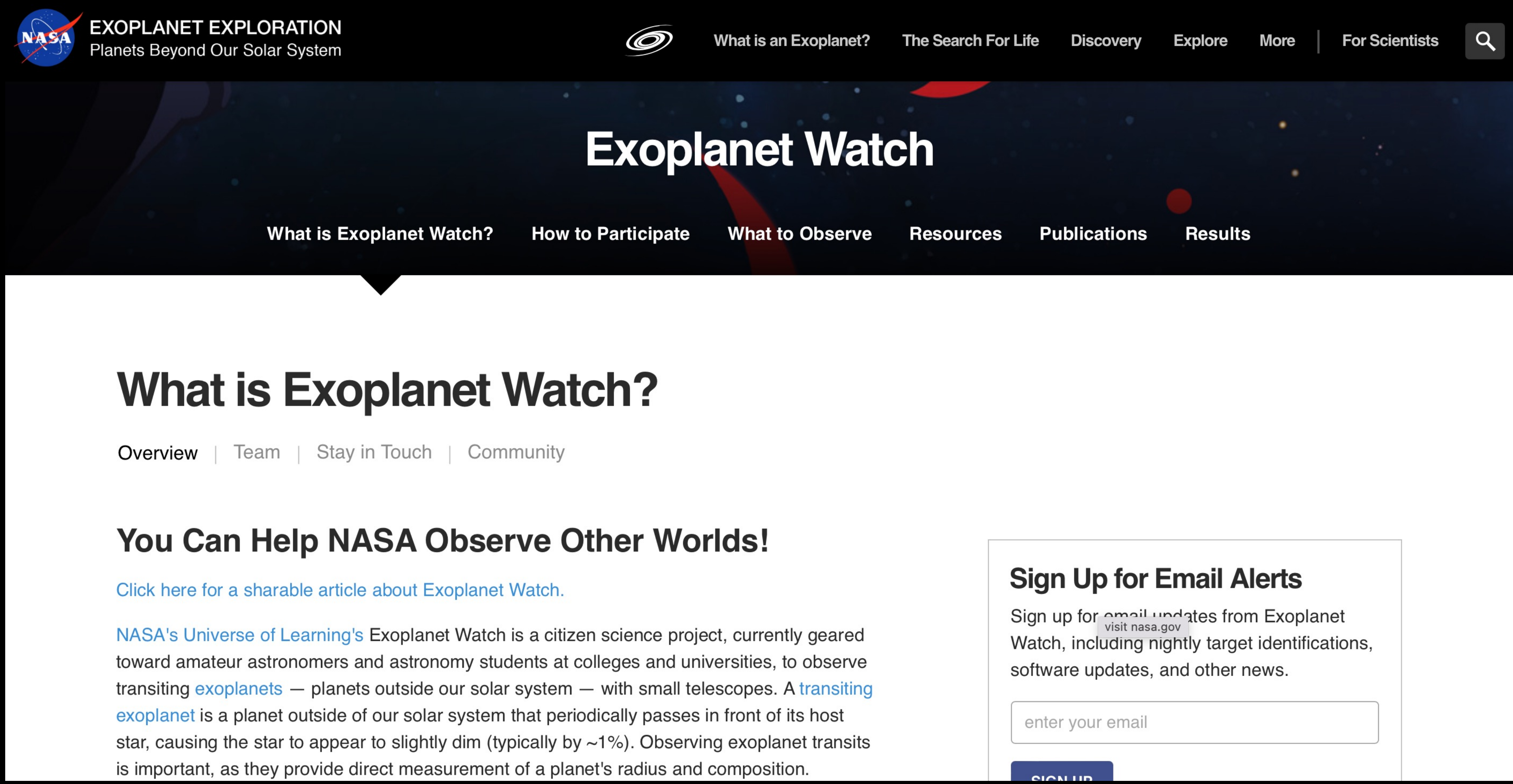

1. Scrape

2. Process

3. Publish

# HOW TO GET INVOLVED?

- Website
- Monthly newsletter
- Slack channel

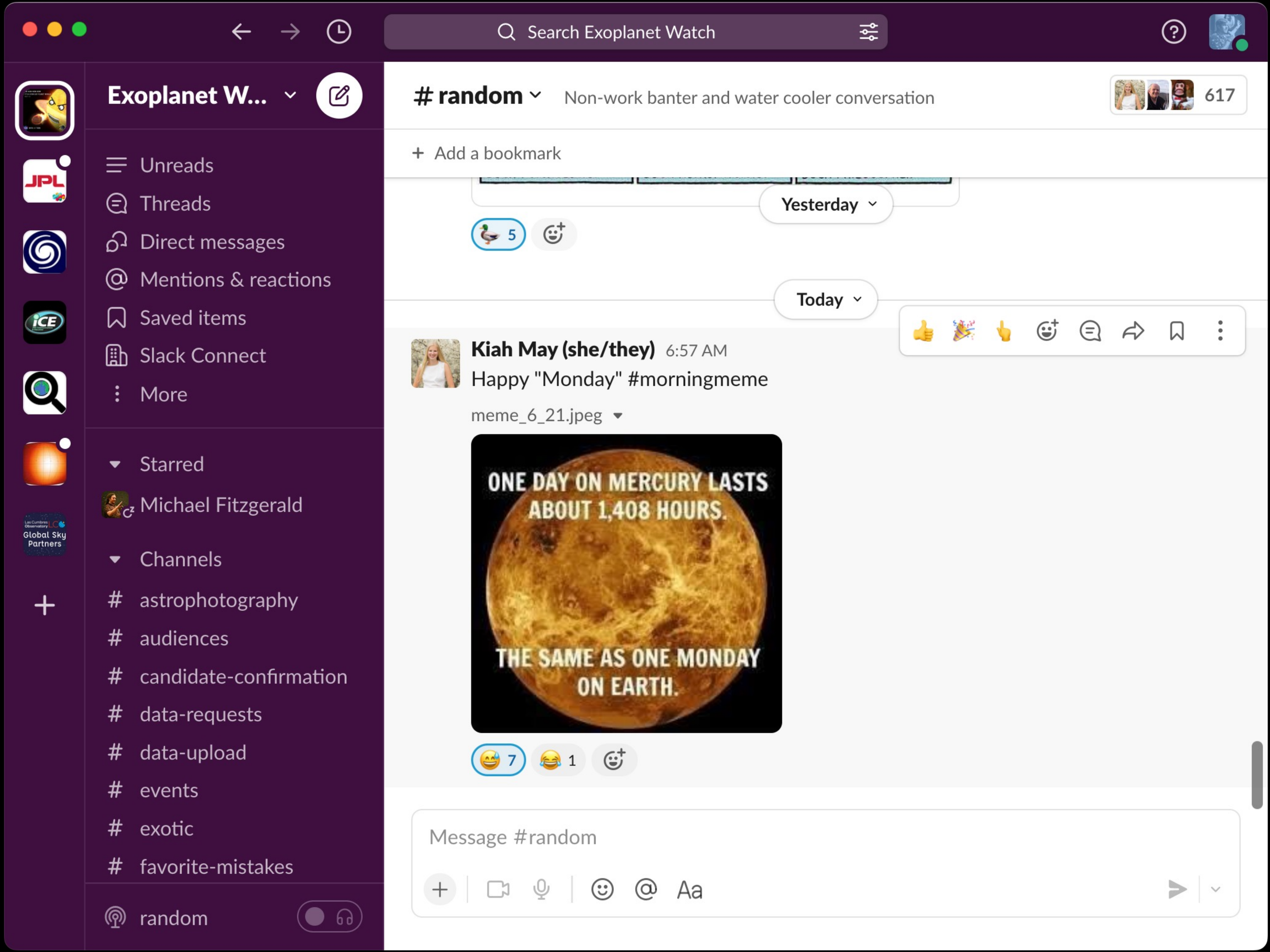


# HOW TO GET INVOLVED?

- Website
- Monthly newsletter
- Slack channel

# HOW TO GET INVOLVED?

- Website
- Monthly newsletter
- Slack channel



# HOW TO GET INVOLVED?

- Currently, launched to those who have their own telescope
- Or access to a robotic one
  - MicroObservatory, LCO
- By end of CY 2022, will be getting additional data to loan out people so that everyone and anyone can participate

Harvard/CfA

# HOW TO GET INVOLVED?

- Currently, launched to those who have their own telescope
- Or access to a robotic one
  - MicroObservatory, LCO
- By end of CY 2022, will be getting additional data to loan out people so that everyone and anyone can participate

NASA/JPL

# HOW TO GET INVOLVED?

- Currently, launched to those who have their own telescope
- Or access to a robotic one
  - MicroObservatory, LCO
- By end of CY 2022, will be getting additional data to loan out people so that everyone and anyone can participate

NASA/JPL

# EXOPLANET WATCH TEAM

Exoplanet Watch Interns

Izzy Huckabee (ASU)

Kiah May (UC Boulder)

Tamim Fatahi (CalPoly SLO)

JPL Team

Nora Bailey

John Engelke

Kyle Pearson

Rachel Zimmerman-Brachman

Rob Zellem