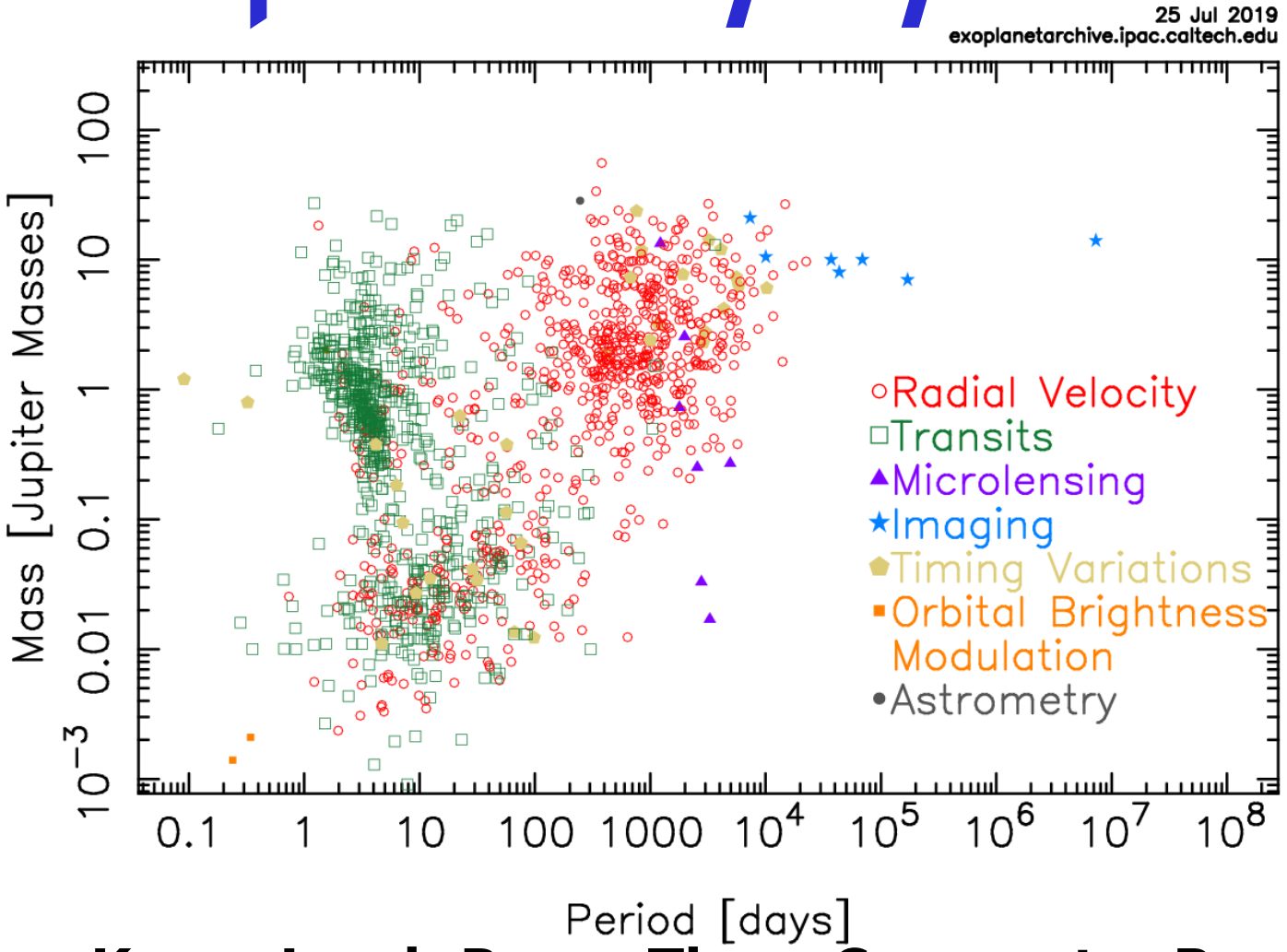
TESS Observations of Known Exoplanetary Systems

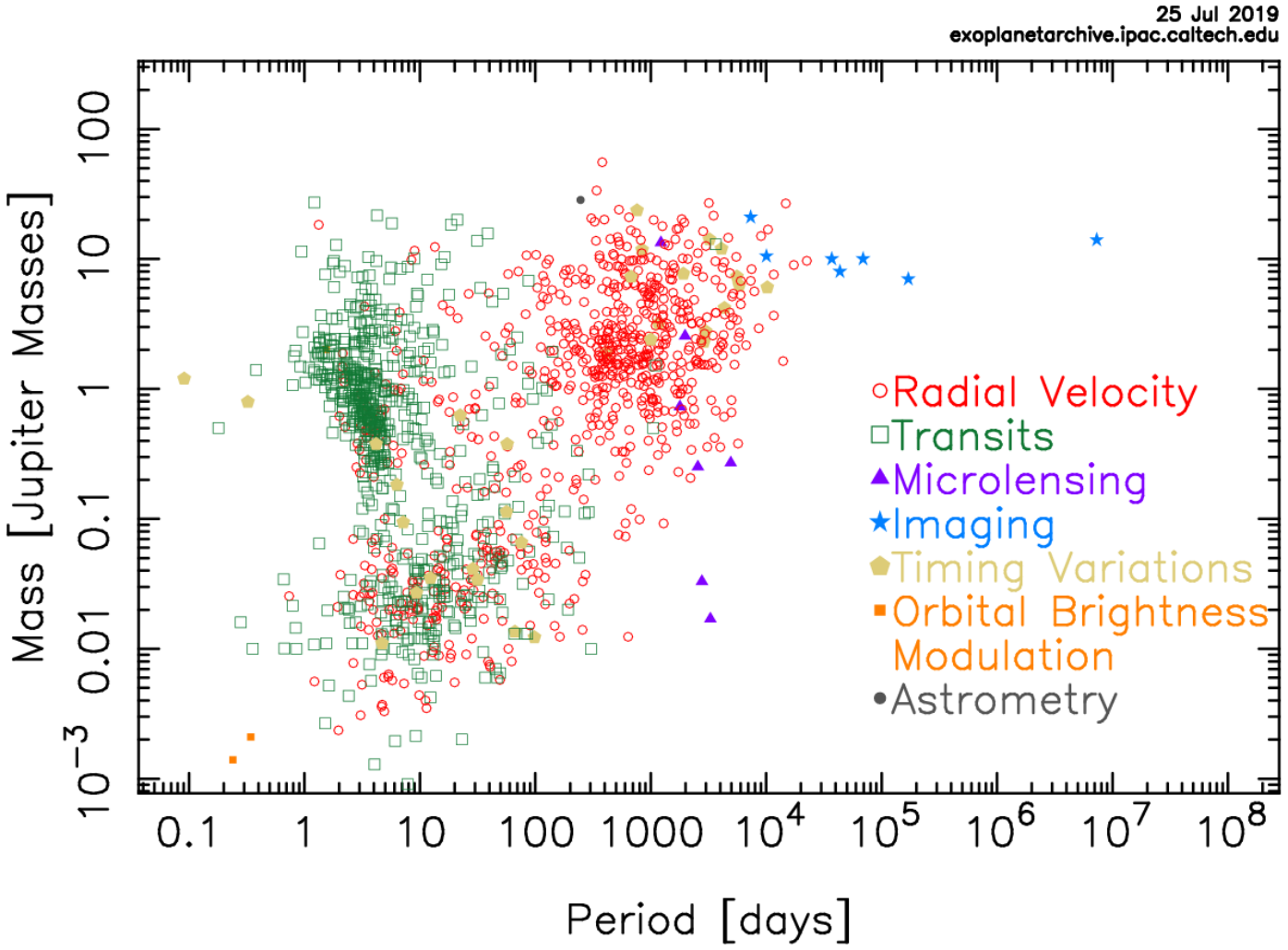


Stephen Kane, Jacob Bean, Tiago Campante, Paul Dalba, Tara Fetherolf, Greg Henry, Teo Mocnik, Joshua Pepper, Darin Ragozzine, Maggie Turnbull

Total number of confirmed planets (as of July 25, 2019):

4,025

Discovery method: Transits 3,114; RVs 760

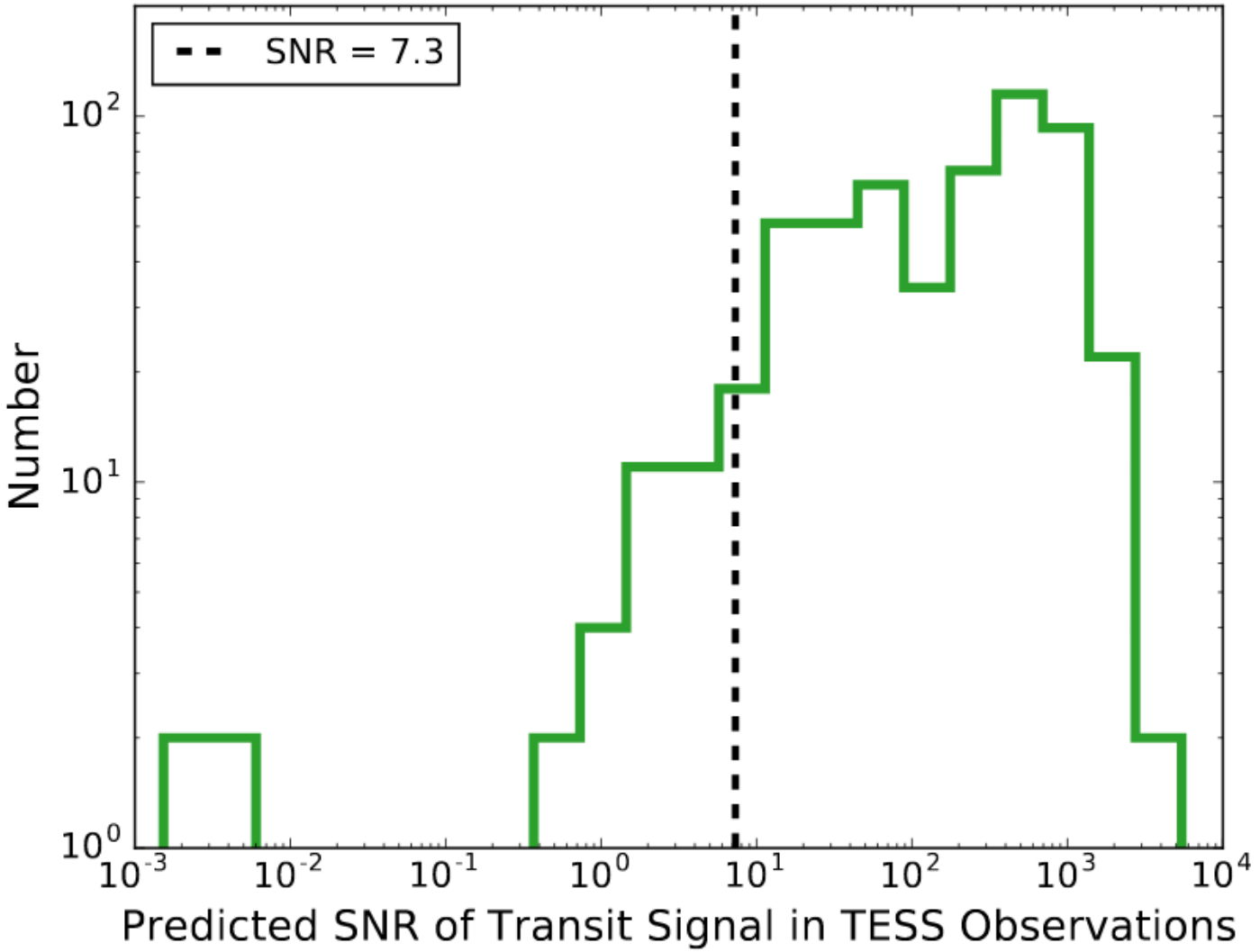


During the TESS primary mission, 83% of known exoplanet hosts will be observed.
(Using the TESS Viewing Tool by Tom Barclay)

Why Study the Known Exoplanets with TESS?

Why Study the Known Exoplanets with TESS?

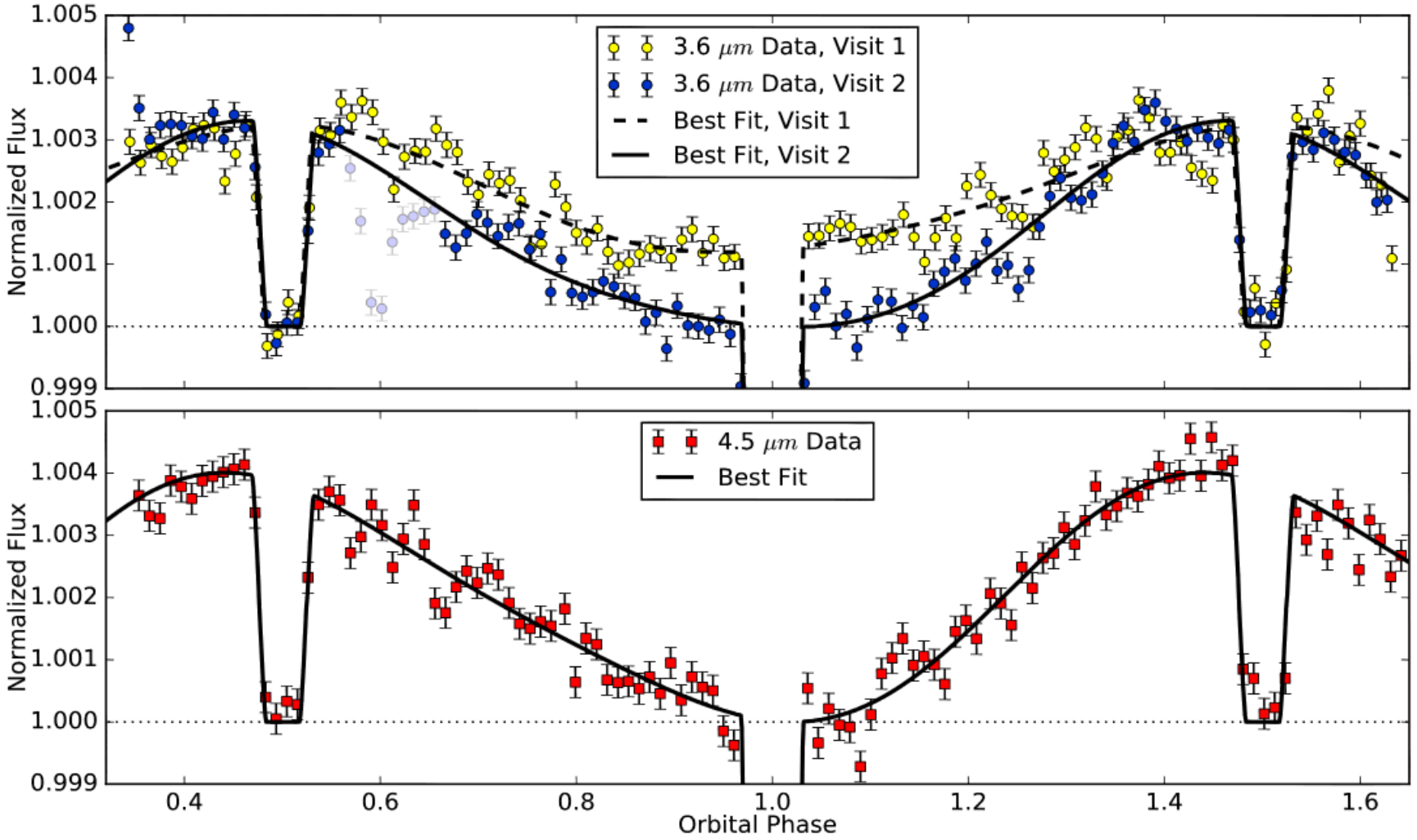
- **Transit detection of known radial velocity planets.**



Dalba et al. 2019, PASP, 131, 034401

Why Study the Known Exoplanets with TESS?

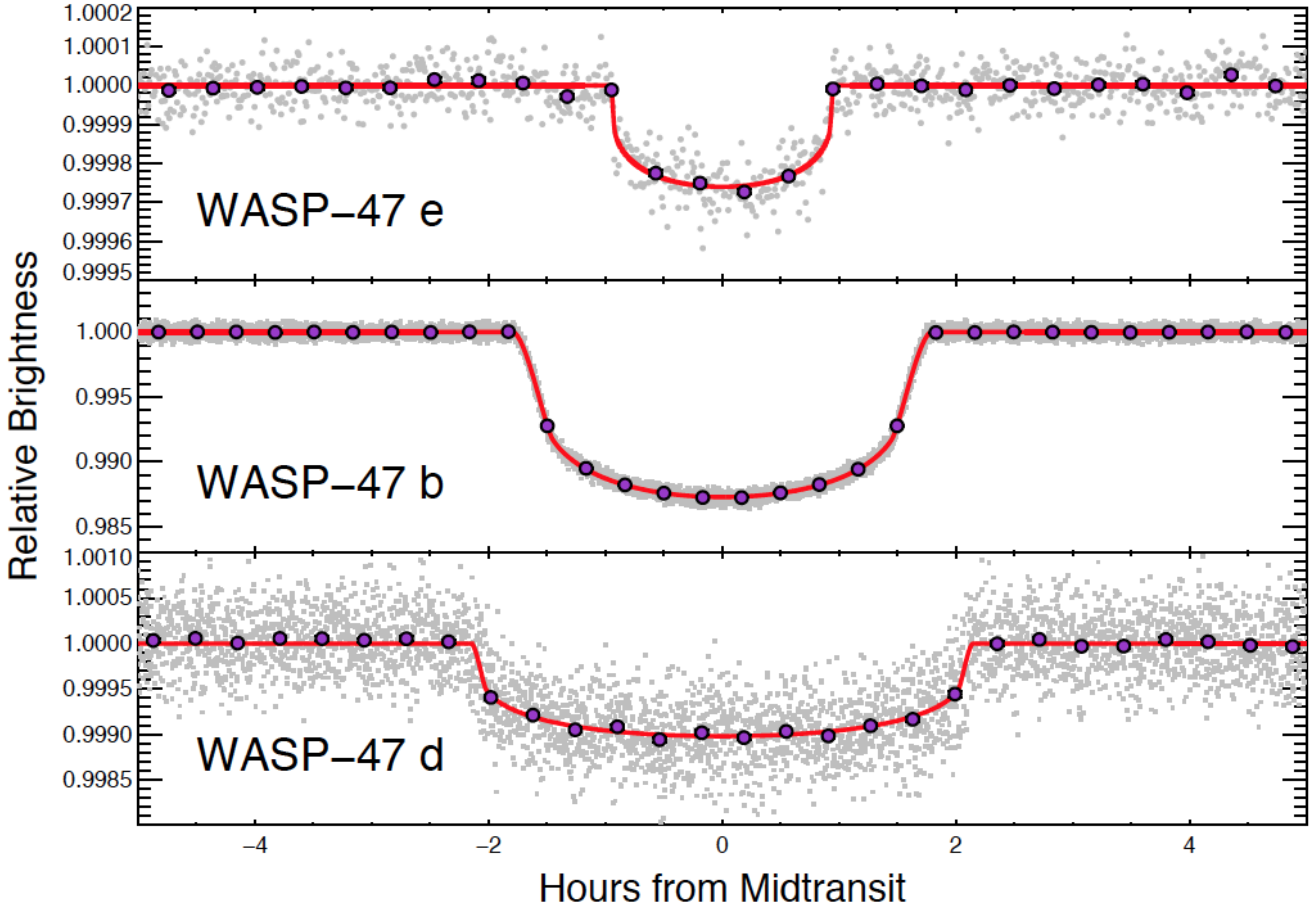
- **Transit detection of known radial velocity planets.**
- **Detection of phase variations, and secondary eclipses for known planets.**



Stevenson et al. 2016, AJ, 153, 68

Why Study the Known Exoplanets with TESS?

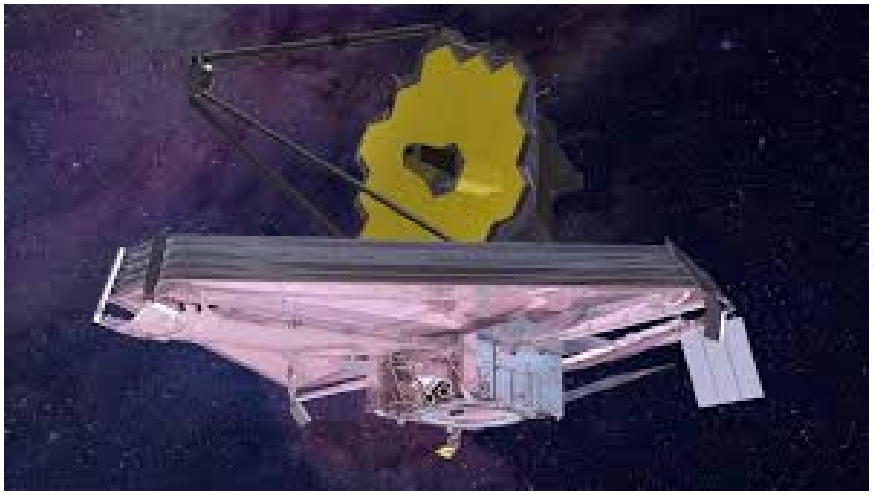
- **Transit detection of known radial velocity planets.**
- **Detection of phase variations, and secondary eclipses for known planets.**
- **Transits of additional planets in known systems.**

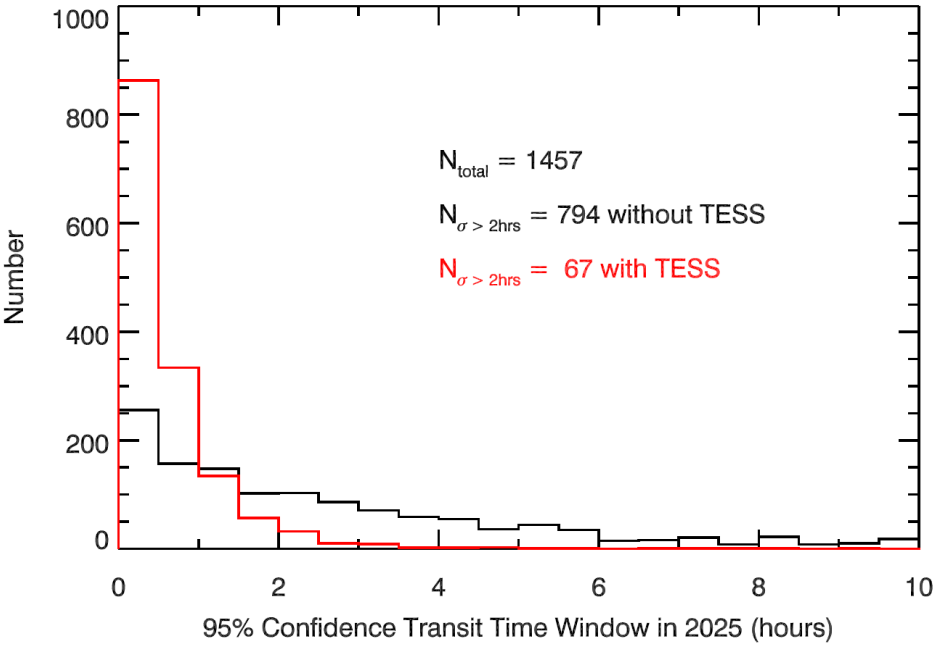


Becker et al. 2015, ApJ, 812, L18

Why Study the Known Exoplanets with TESS?

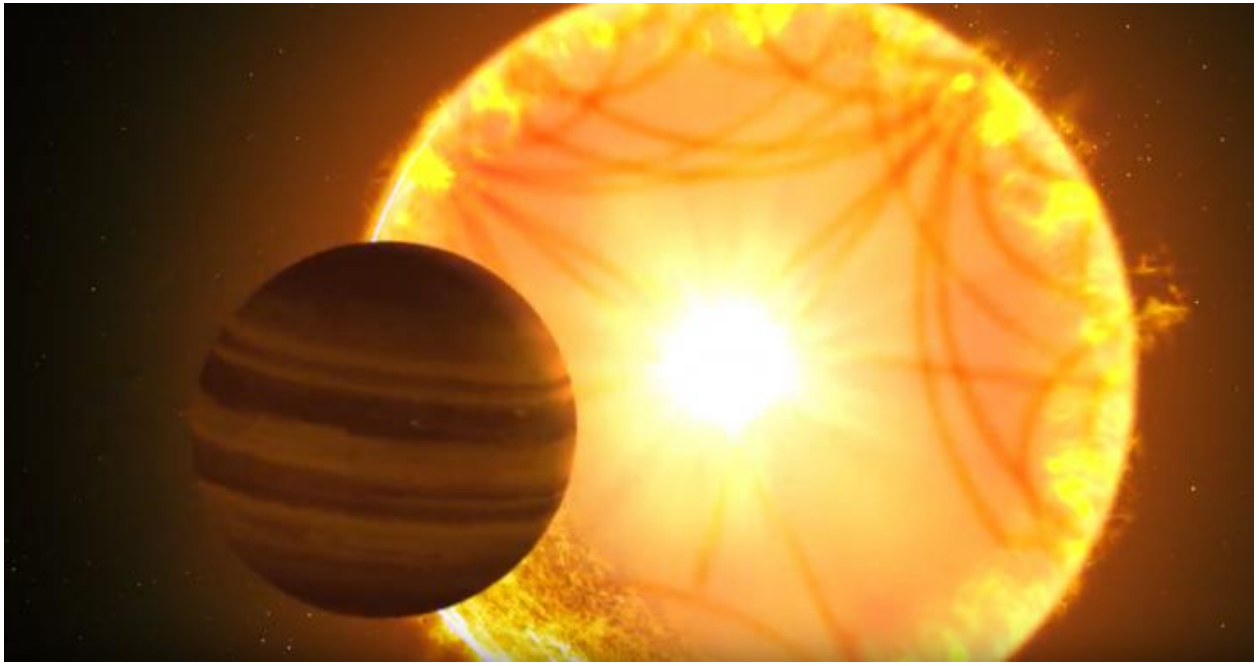
- **Transit detection of known radial velocity planets.**
- **Detection of phase variations, and secondary eclipses for known planets.**
- **Transits of additional planets in known systems.**
- **Ephemeris refinement for known transiters:**
  - **Preparation for JWST observations.**
  - **Additional TTVs of known transiting planets.**
  - **Orbital decay for Hot Jupiters**





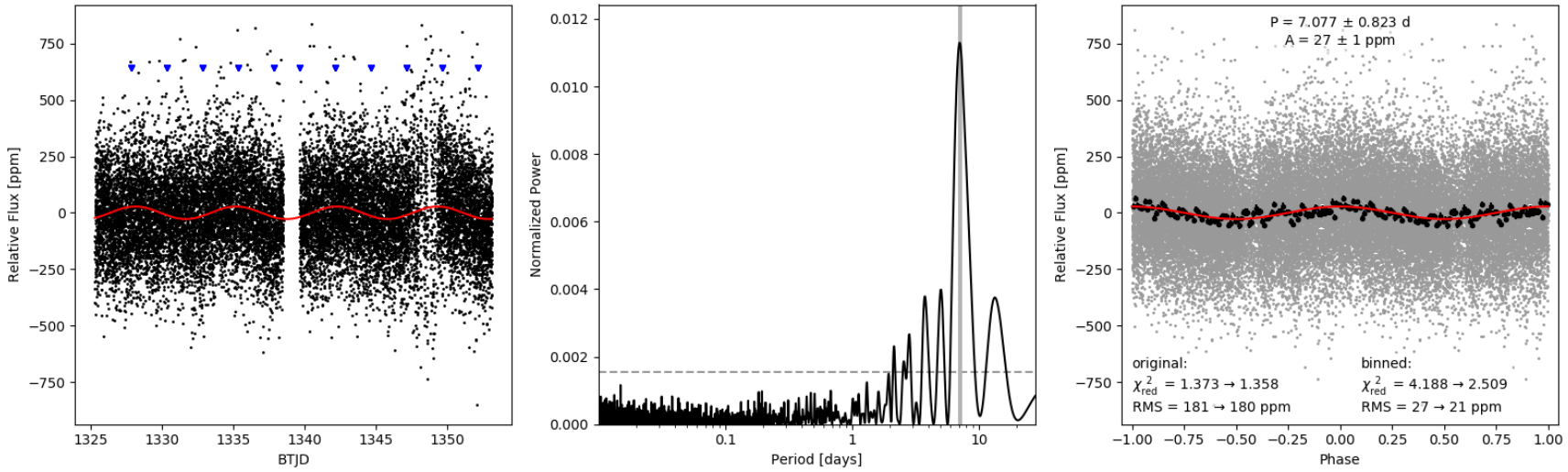
Why Study the Known Exoplanets with TESS?

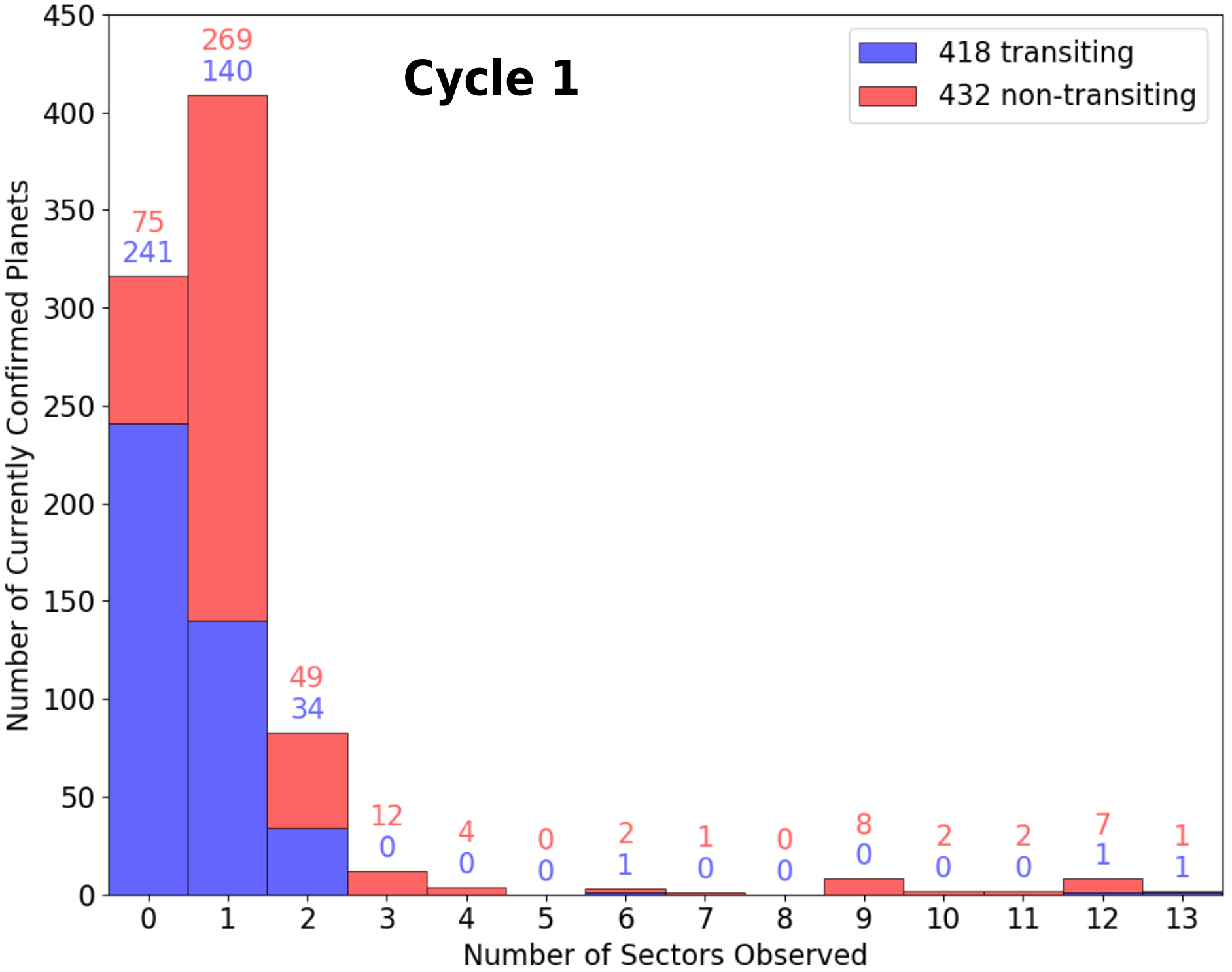
- **Transit detection of known radial velocity planets.**
- **Detection of phase variations, and secondary eclipses for known planets.**
- **Transits of additional planets in known systems.**
- **Ephemeris refinement for known transiters:**
  - **Preparation for JWST observations.**
  - **Additional TTVs of known transiting planets.**
  - **Orbital decay for Hot Jupiters**
- **Astroseismology of known planet hosts.**

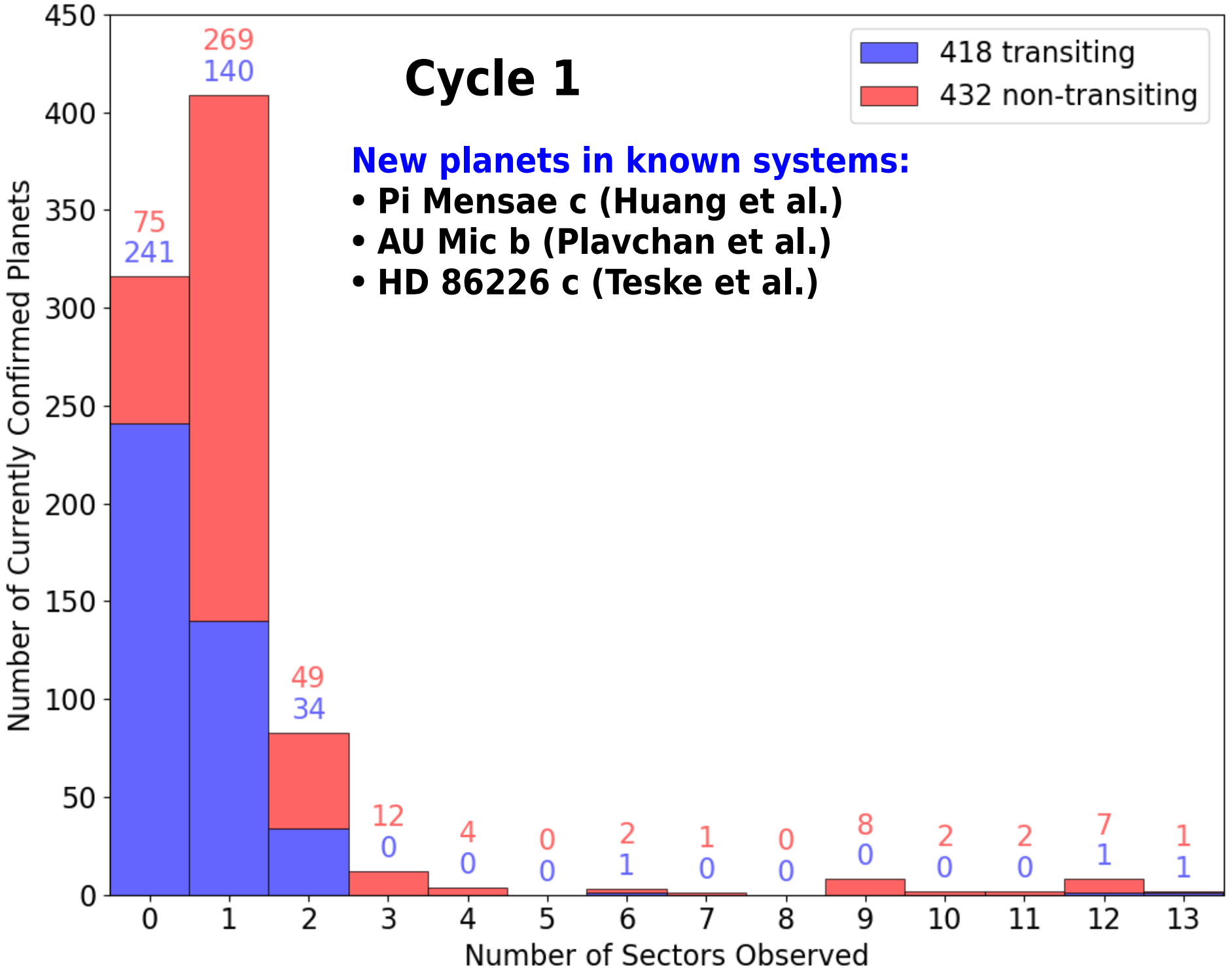


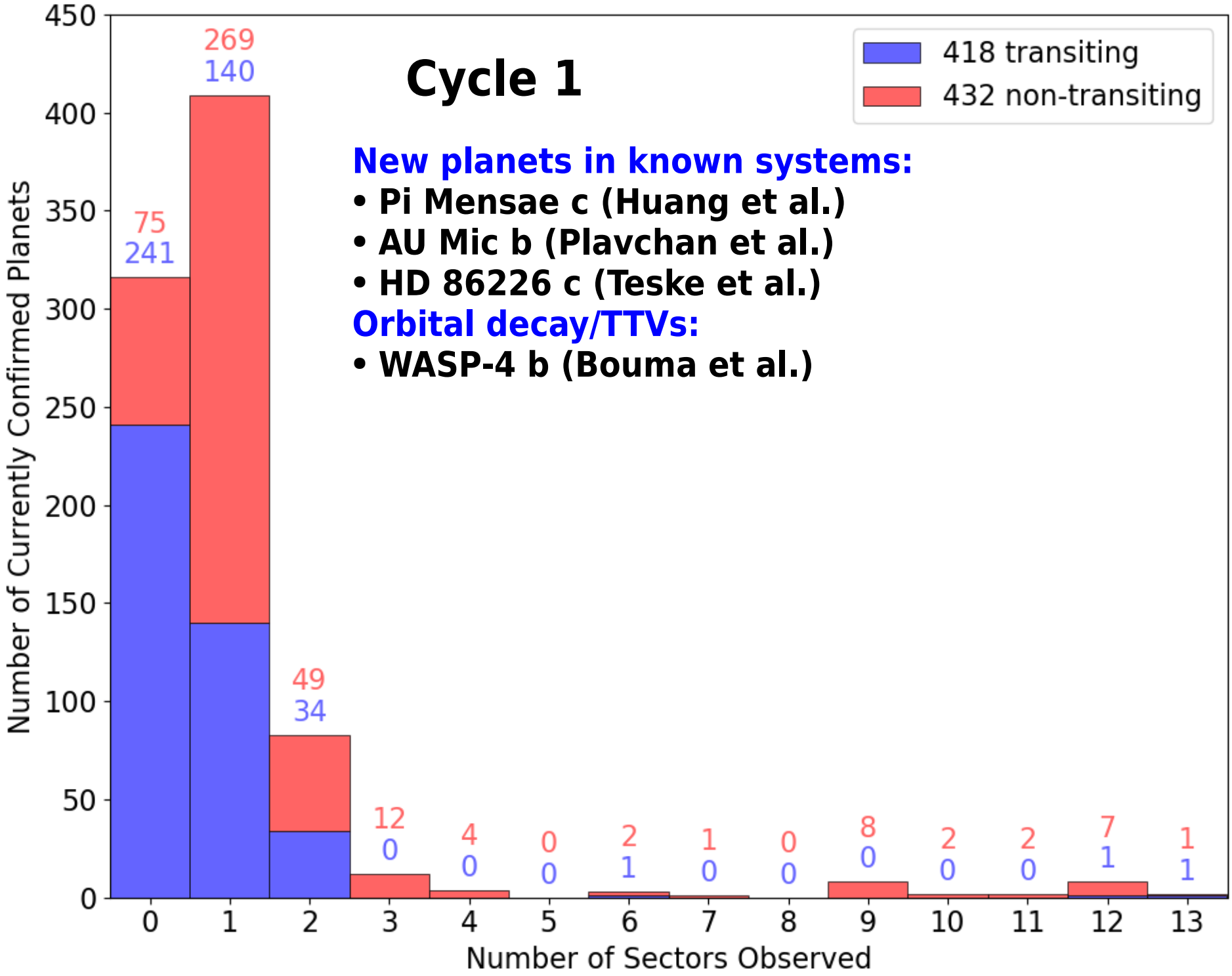
Why Study the Known Exoplanets with TESS?

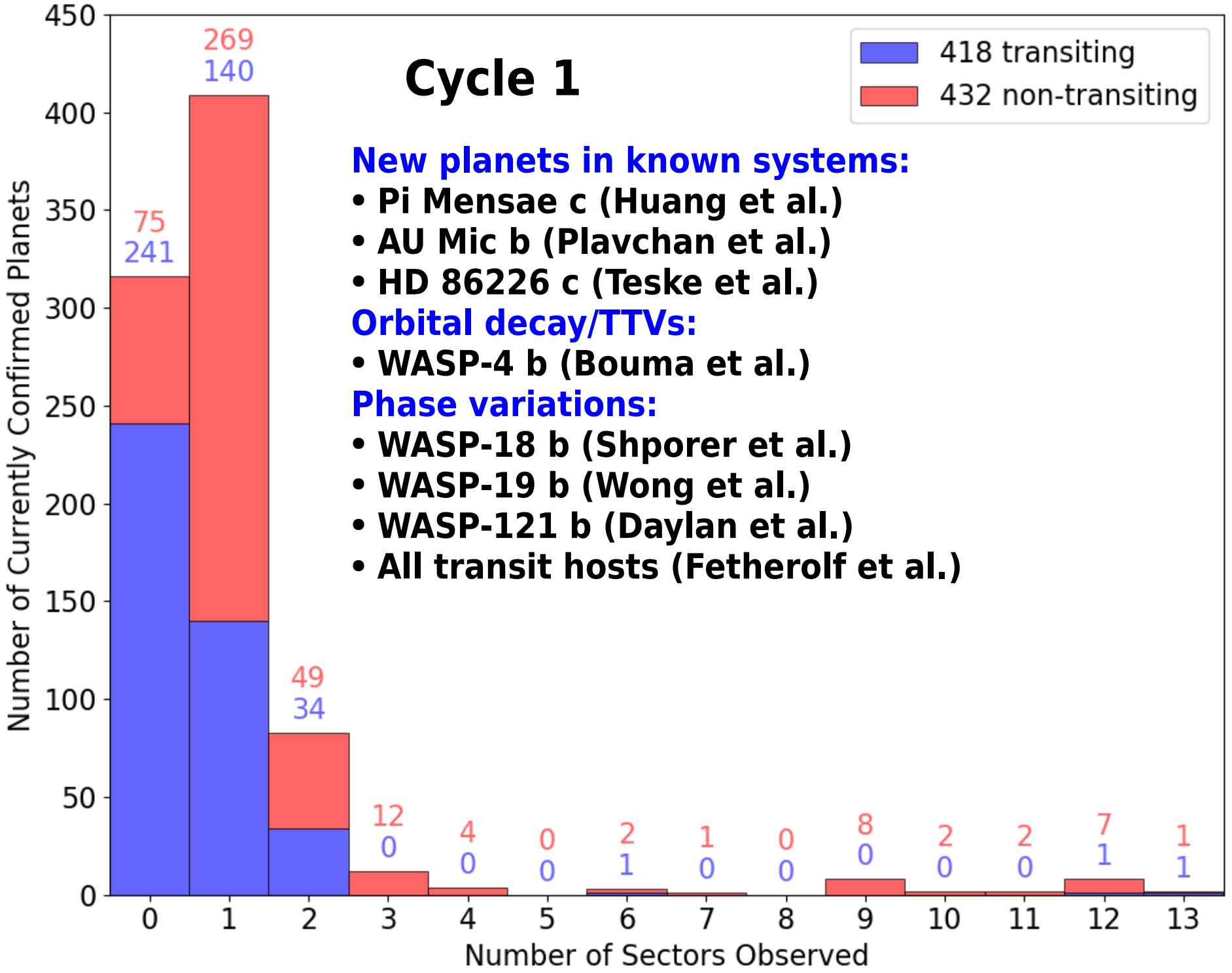
- **Transit detection of known radial velocity planets.**
- **Detection of phase variations, and secondary eclipses for known planets.**
- **Transits of additional planets in known systems.**
- **Ephemeris refinement for known transiters:**
  - **Preparation for JWST observations.**
  - **Additional TTVs of known transiting planets.**
  - **Orbital decay for Hot Jupiters**
- **Astroseismology of known planet hosts.**
- **Intrinsic stellar variability of known exoplanet hosts.**

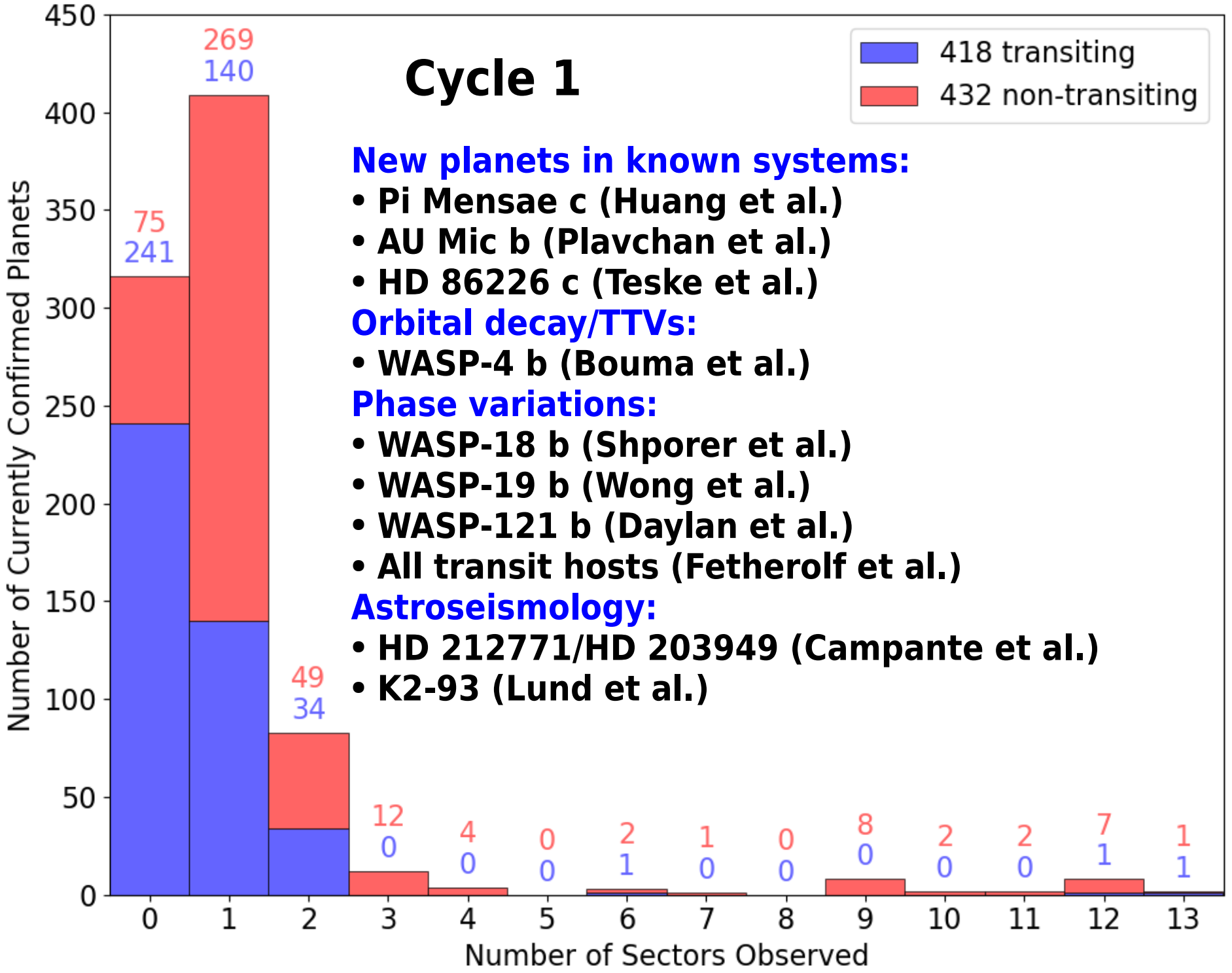


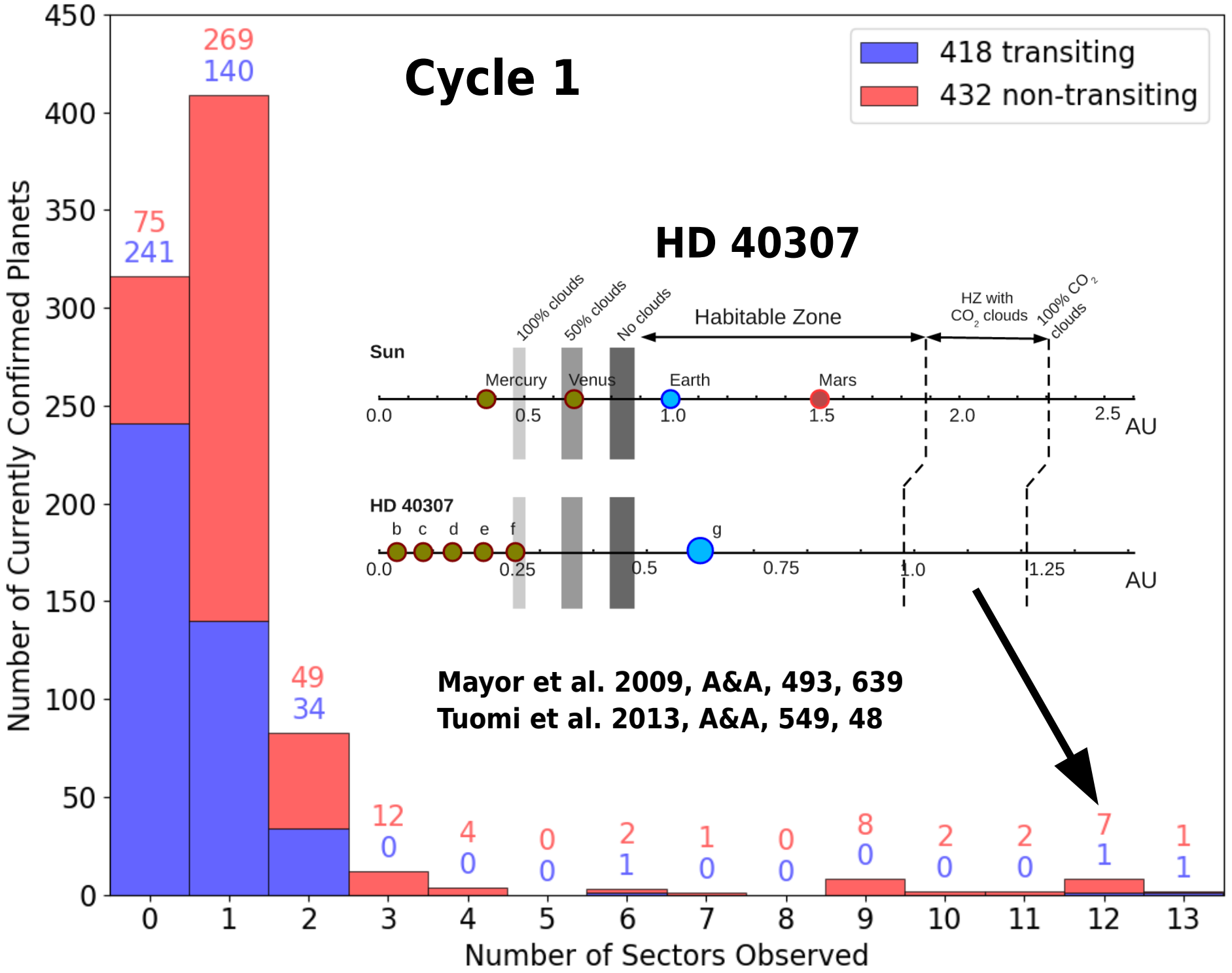

Cycle 1
418 transiting
432 non-transiting
Number of Currently Confirmed Planets
Number of Sectors Observed
0
50
100
150
200
250
300
350
400
450
0 1 2 3 4 5 6 7 8 9 10 11 12 13
75
241
269
140
49
34
12
0
4
0
0
0
2
1
1
0
0
0
8
0
2
0
2
0
7
1
1
1

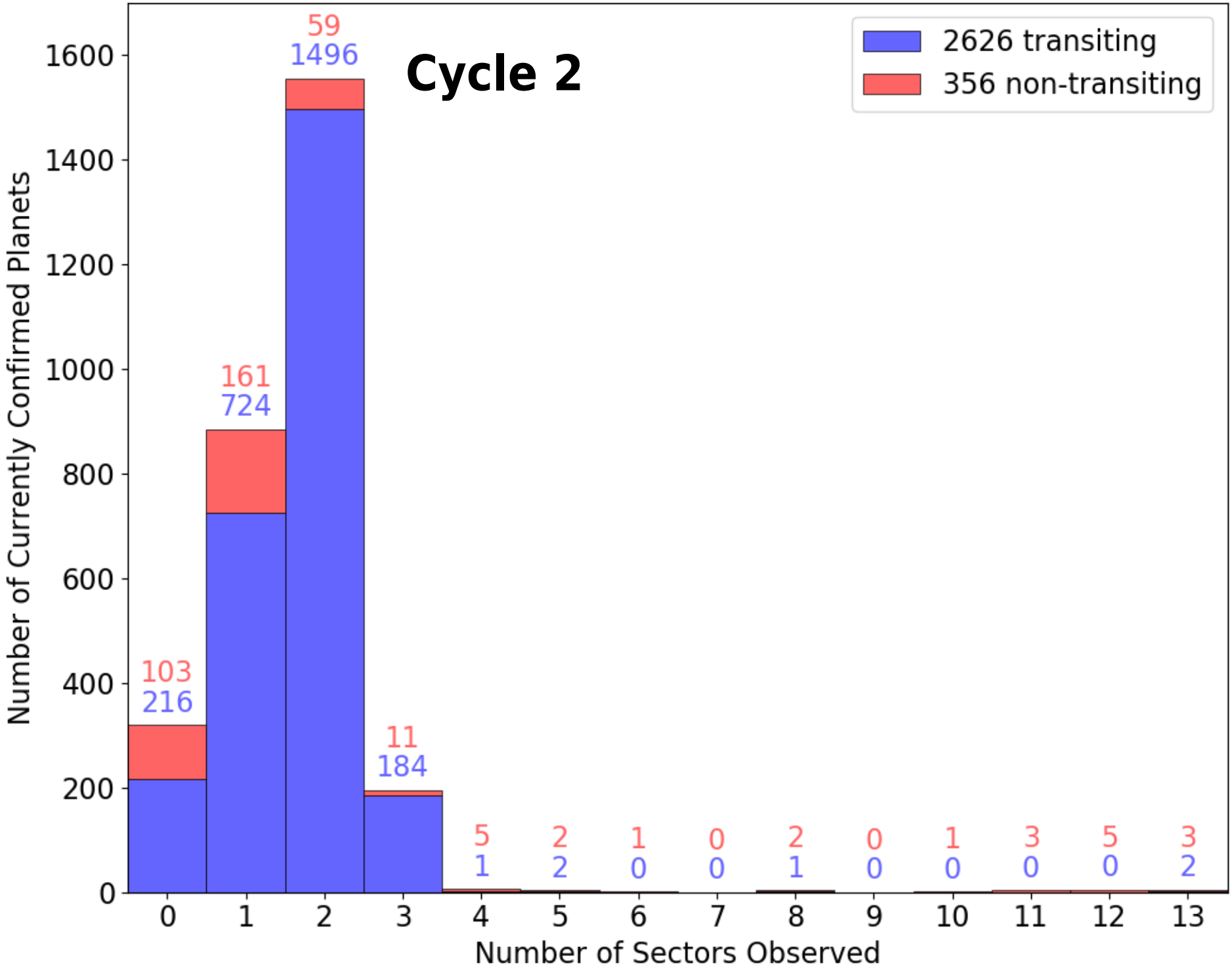

Cycle 1
418 transiting
432 non-transiting
New planets in known systems:
• Pi Mensae c (Huang et al.)
• AU Mic b (Plavchan et al.)
• HD 86226 c (Teske et al.)
Number of Currently Confirmed Planets
Number of Sectors Observed
0
50
100
150
200
250
300
350
400
450
0 1 2 3 4 5 6 7 8 9 10 11 12 13
75
241
269
140
49
34
12
0
4
0
0
0
2
1
1
0
0
0
8
0
2
0
2
0
7
1
1
1

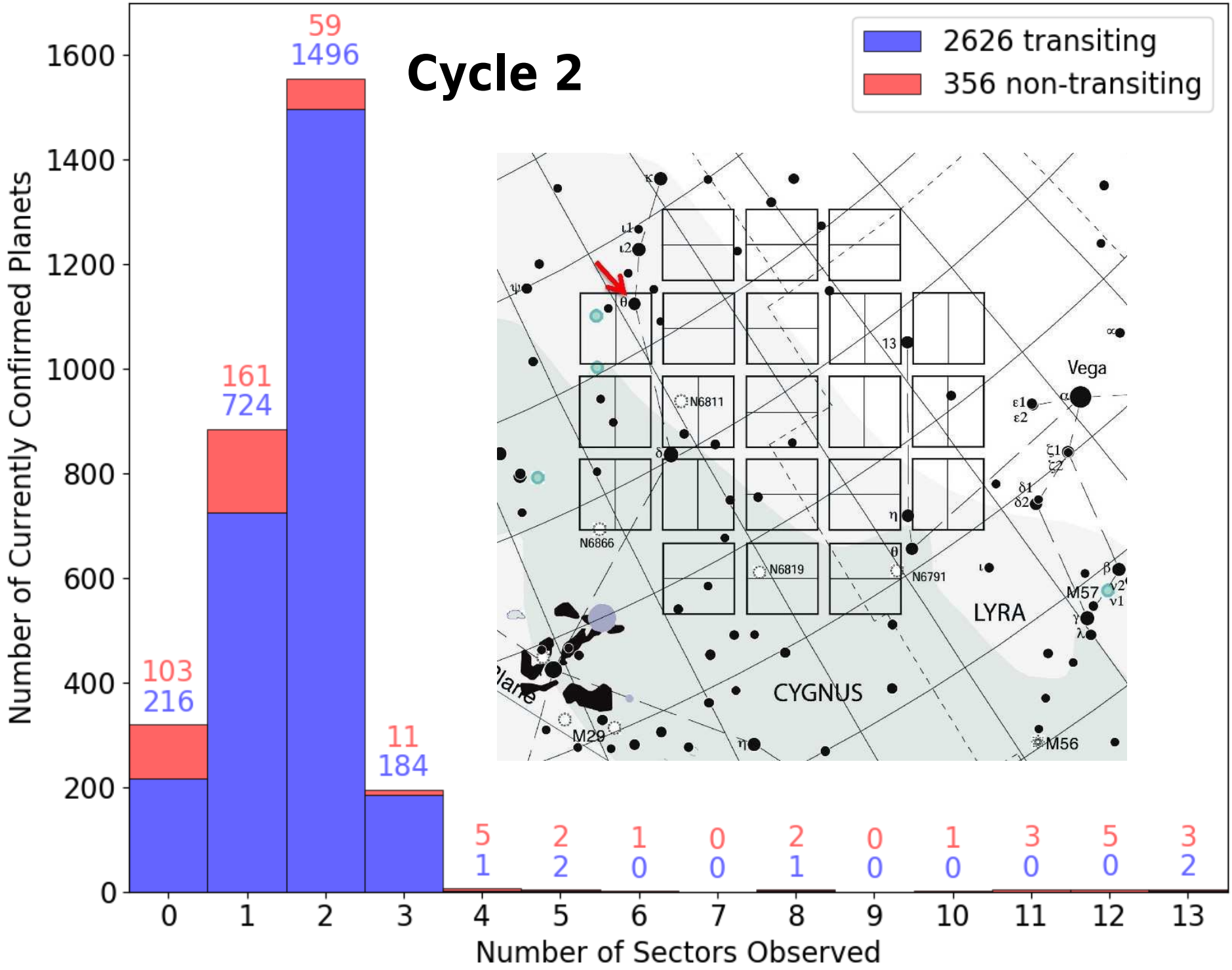

Cycle 1
418 transiting
432 non-transiting
New planets in known systems:
• Pi Mensae c (Huang et al.)
• AU Mic b (Plavchan et al.)
• HD 86226 c (Teske et al.)
Orbital decay/TTVs:
• WASP-4 b (Bouma et al.)
Number of Currently Confirmed Planets
Number of Sectors Observed
0 50 100 150 200 250 300 350 400 450
0 1 2 3 4 5 6 7 8 9 10 11 12 13
75 241
269 140
49 34
12 0
4 0
0 0
2 1
1 0
0 0
8 0
2 0
2 0
7 1
1 1


Cycle 1
418 transiting
432 non-transiting
New planets in known systems:
• Pi Mensae c (Huang et al.)
• AU Mic b (Plavchan et al.)
• HD 86226 c (Teske et al.)
Orbital decay/TTVs:
• WASP-4 b (Bouma et al.)
Phase variations:
• WASP-18 b (Shporer et al.)
• WASP-19 b (Wong et al.)
• WASP-121 b (Daylan et al.)
• All transit hosts (Fetherolf et al.)
Number of Currently Confirmed Planets
Number of Sectors Observed
0 50 100 150 200 250 300 350 400 450
0 1 2 3 4 5 6 7 8 9 10 11 12 13
75 241
269 140
49 34
12 0
4 0
0 0
2 1
1 0
0 0
8 0
2 0
2 0
7 1
1 1


Cycle 1
418 transiting
432 non-transiting
New planets in known systems:
• Pi Mensae c (Huang et al.)
• AU Mic b (Plavchan et al.)
• HD 86226 c (Teske et al.)
Orbital decay/TTVs:
• WASP-4 b (Bouma et al.)
Phase variations:
• WASP-18 b (Shporer et al.)
• WASP-19 b (Wong et al.)
• WASP-121 b (Daylan et al.)
• All transit hosts (Fetherolf et al.)
Astroseismology:
• HD 212771/HD 203949 (Campante et al.)
• K2-93 (Lund et al.)
Number of Currently Confirmed Planets
Number of Sectors Observed
0 50 100 150 200 250 300 350 400 450
0 1 2 3 4 5 6 7 8 9 10 11 12 13
75 241
269 140
49 34
12 0
4 0
0 0
2 1
1 0
0 0
8 0
2 0
2 0
7 1
1 1


Cycle 1
418 transiting
432 non-transiting
HD 40307
Habitable Zone
100% clouds
50% clouds
No clouds
HZ with CO2 clouds
100% CO2 clouds
Sun
Mercury
Venus
Earth
Mars
AU
HD 40307
b c d e f
g
AU
Mayor et al. 2009, A&A, 493, 639
Tuomi et al. 2013, A&A, 549, 48
Number of Currently Confirmed Planets
Number of Sectors Observed
269
140
75
241
49
34
12
0
4
0
0
0
2
1
1
0
0
0
8
0
2
0
2
0
7
1
1
1


Cycle 2
2626 transiting
356 non-transiting
Number of Currently Confirmed Planets
Number of Sectors Observed
0
200
400
600
800
1000
1200
1400
1600
0 1 2 3 4 5 6 7 8 9 10 11 12 13
103
216
161
724
59
1496
11
184
5
1
2
2
1
0
0
0
2
1
0
0
1
0
3
0
5
0
3
2


Cycle 2
2626 transiting
356 non-transiting
Number of Currently Confirmed Planets
Number of Sectors Observed
59
1496
161
724
103
216
11
184
5
1
2
2
1
0
0
2
0
0
1
0
3
0
5
0
3
2
0
200
400
600
800
1000
1200
1400
1600
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Vega
LYRA
CYGNUS
M57
M56
M29
N6811
N6866
N6819
N6791
13

Why Study the Known Exoplanets with TESS?

- **Transit detection of known radial velocity planets.**
- **Detection of phase variations, and secondary eclipses for known planets.**
- **Transits of additional planets in known systems.**
- **Ephemeris refinement for known transiters:**
  - **Preparation for JWST observations.**
  - **Additional TTVs of known transiting planets.**
  - **Orbital decay for Hot Jupiters**
- **Astroseismology of known planet hosts.**
- **Intrinsic stellar variability of known exoplanet hosts.**

Feel free to ask me for known exoplanet data.