

# NASA Exoplanet Archive

## Planetary Systems

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# DATA SOURCES

## NASA Exoplanet Archive (3 Tables)

### Planetary Systems

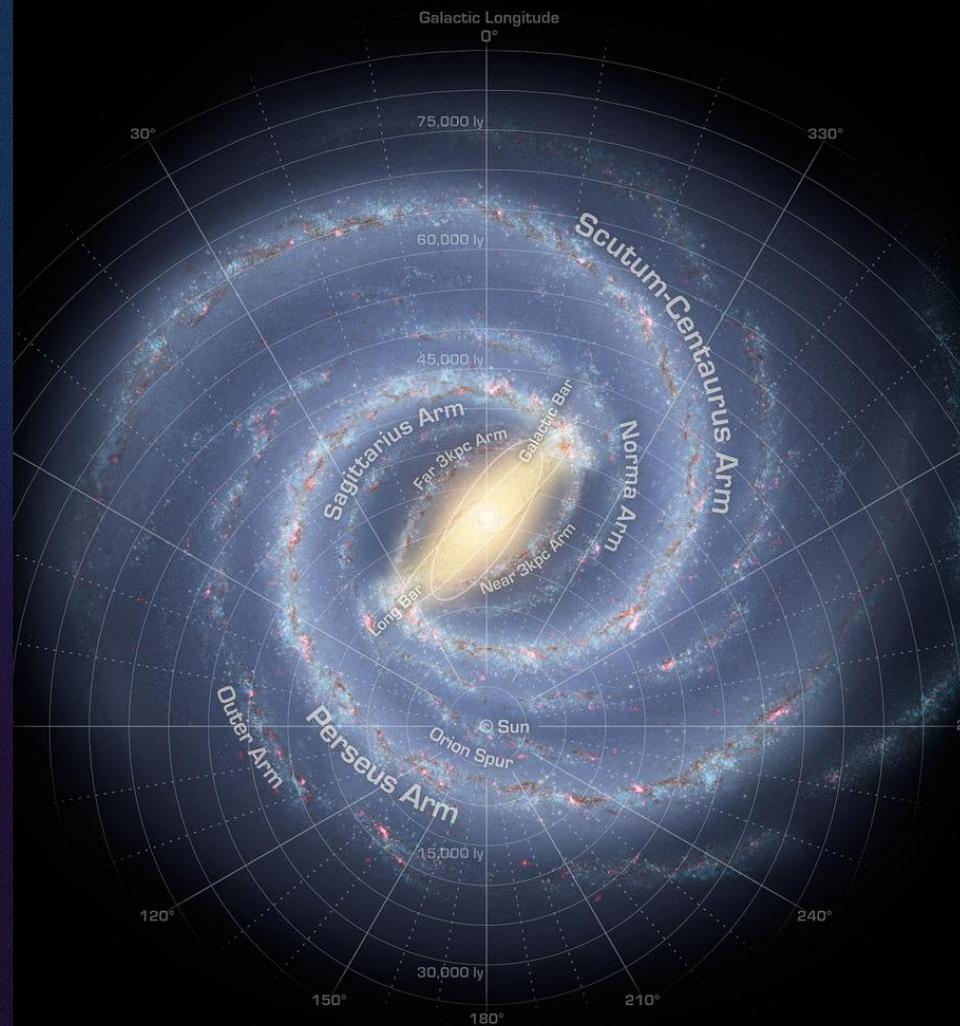
- 36424 rows × 288 columns
- Contains all confirmed exoplanet data, with one row per planet, per reference.

### Planetary Systems Composite

- 5788 rows × 319 columns
- Composites planets with multiple references.

### TESS Candidates

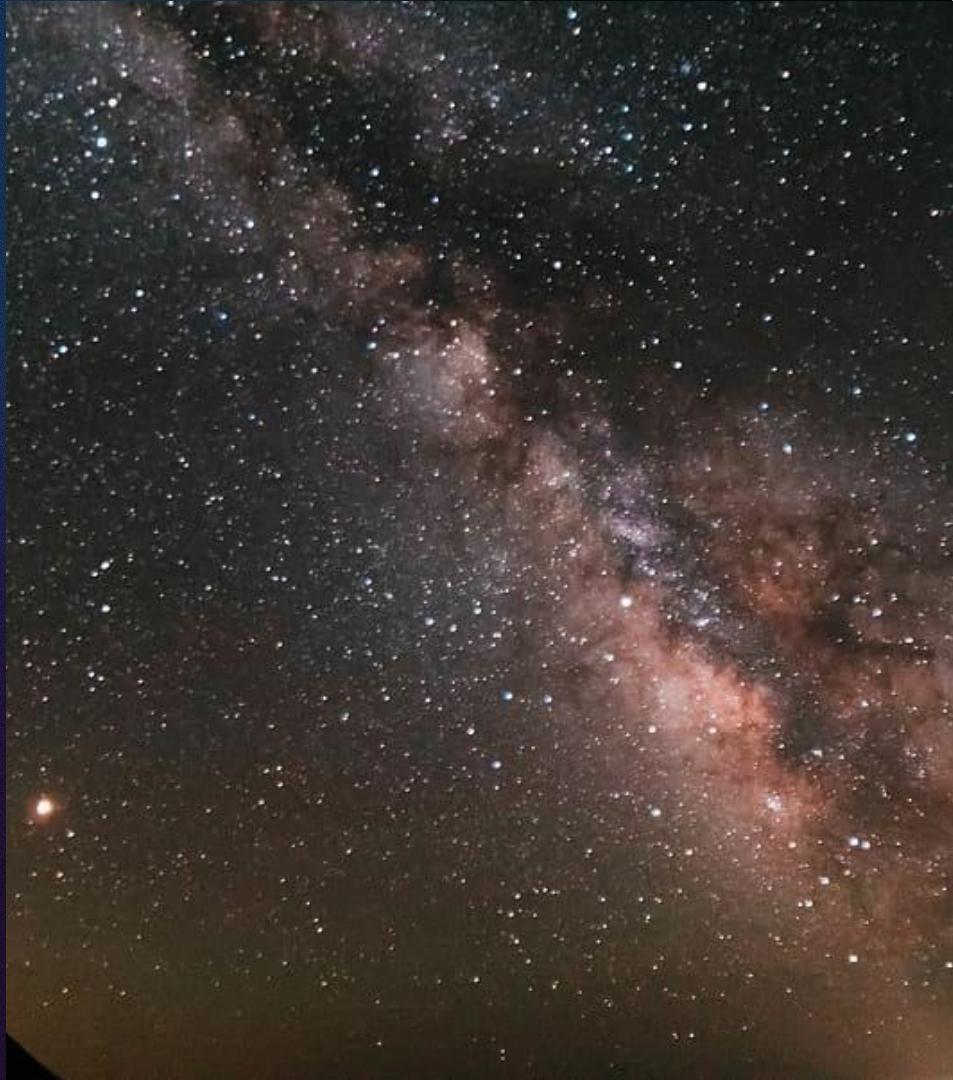
- 7351 rows × 87 columns
- Non-confirmed planetary candidates from the TESS space telescope.



# The Columns

| Field           | Description                                | Field          | Description  | Field            | Description                                      | Field           | Description  | Field        | Description                            | Field          | Description                                    | Field | Description |
|-----------------|--|----------------|--|------------------|--|-----------------|--|--------------|--|----------------|--|-------|-------------|
| pl.name         | Planet Name                                | pl.masser1     | Planet Mass [Earth Mass] Upper Unc.                            | pl.orbinderr2    | Inclination Lower Unc. [deg]                     | pl.trueobliqu2  | True Obliquity Lower Unc. [deg]                                | rast         | RA [sexagesimal]                       | sy_zmag        | z (Sloan) Magnitude                            |       |             |
| hostname        | Host Name                                  | pl.masser2     | Planet Mass [Earth Mass] Lower Unc.                            | pl.orbindlim     | Inclination Limit Flag                           | pl.trueobliqlim | True Obliquity Limit Flag                                      | ra           | RA [deg]                               | sy_zmagerr1    | z (Sloan) Magnitude Upper Unc                  |       |             |
| pl.letter       | Planet Letter                              | pl.masslim     | Planet Mass [Earth Mass] Limit Flag                            | pl.tranmid       | Transit Midpoint [days]                          | st.refname      | Stellar Parameter Reference                                    | decstr       | Dec [sexagesimal]                      | sy_zmagerr2    | z (Sloan) Magnitude Lower Unc                  |       |             |
| hd.name         | HD ID                                      | pl.massj       | Planet Mass [Jupiter Mass]                                     | pl.tranmiderr1   | Transit Midpoint Upper Unc. [days]               | st.spectype     | Spectral Type  | dec          | Dec [deg]                              | sy_wImag       | W1 (WISE) Magnitude                            |       |             |
| hip.name        | HIP ID                                     | pl.masserj1    | Planet Mass [Jupiter Mass] Upper Unc.                          | pl.tranmiderr2   | Transit Midpoint Lower Unc. [days]               | st.teff         | Stellar Effective Temperature [K]                              | glat         | Galactic Latitude [deg]                | sy_wImager1    | W1 (WISE) Magnitude Upper Unc                  |       |             |
| tic.id          | TEC ID                                     | pl.masserj2    | Planet Mass [Jupiter Mass] Lower Unc.                          | pl.tranmidlim    | Transit Midpoint Limit Flag                      | st.tefferr1     | Stellar Effective Temperature Upper Unc. [K]                   | glon         | Galactic Longitude [deg]               | sy_wImager2    | W1 (WISE) Magnitude Lower Unc                  |       |             |
| gaia.id         | GAIA ID                                    | pl.massjlim    | Planet Mass [Jupiter Mass] Limit Flag                          | pl.tsystemref    | Time Reference Frame and Standard                | st.tefferr2     | Stellar Effective Temperature Lower Unc. [K]                   | elat         | Ecliptic Latitude [deg]                | sy_w2mag       | W2 (WISE) Magnitude                            |       |             |
| default.flag    | Default Parameter Set                      | pl.msinie      | Planet Mass <sup>n</sup> (i) [Earth Mass]                      | ttv.flag         | Data show Transit Timing Variations              | st.tefflim      | Stellar Effective Temperature Limit Flag                       | elon         | Ecliptic Longitude [deg]               | sy_w2mager1    | W2 (WISE) Magnitude Upper Unc                  |       |             |
| sy.nstar        | Number of Stars                            | pl.msinieerr1  | Planet Mass <sup>n</sup> (i) [Earth Mass] Upper Unc.           | pl.impar         | Impact Parameter                                 | st.rad          | Stellar Radius [Solar Radius]                                  | sy_pm        | Total Proper Motion [mas/yr]           | sy.w2mager2    | W2 (WISE) Magnitude Lower Unc                  |       |             |
| sy.nplan        | Number of Planets                          | pl.msinieerr2  | Planet Mass <sup>n</sup> (i) [Earth Mass] Lower Unc.           | pl.imparerr1     | Impact Parameter Upper Unc.                      | st.raderr1      | Stellar Radius Upper Unc. [Solar Radius]                       | sy_pmerr1    | Total Proper Motion Upper Unc [mas/yr] | sy_w3mag       | W3 (WISE) Magnitude                            |       |             |
| sy.nmon         | Number of Moons                            | pl.msinilim    | Planet Mass <sup>n</sup> (i) [Earth Mass] Limit Flag           | pl.imparerr2     | Impact Parameter Lower Unc.                      | st.raderr2      | Stellar Radius Lower Unc. [Solar Radius]                       | sy_pmerr2    | Total Proper Motion Lower Unc [mas/yr] | sy_w3mager1    | W3 (WISE) Magnitude Upper Unc                  |       |             |
| cb.flag         | Circumbinary Flag                          | pl.msinij      | Planet Mass <sup>n</sup> (i) [Jupiter Mass]                    | pl.imparlim      | Impact Parameter Limit Flag                      | st.radlim       | Stellar Radius Limit Flag                                      | sy_pmra      | Proper Motion (RA) [mas/yr]            | sy_w3mager2    | W3 (WISE) Magnitude Lower Unc                  |       |             |
| discoverymethod | Discovery Method                           | pl.msinijerr1  | Planet Mass <sup>n</sup> (i) [Jupiter Mass] Upper Unc.         | pl.trandep       | Transit Depth [%]                                | st.mass         | Stellar Mass [Solar mass]                                      | sy_pmraerr1  | Proper Motion (RA) [mas/yr] Upper Unc  | sy_w4mag       | W4 (WISE) Magnitude                            |       |             |
| disc.year       | Discovery Year                             | pl.msinijerr2  | Planet Mass <sup>n</sup> (i) [Jupiter Mass] Lower Unc.         | pl.trandeperr1   | Transit Depth Upper Unc. [%]                     | st.masserr1     | Stellar Mass Upper Unc. [Solar mass]                           | sy_pmraerr2  | Proper Motion (RA) [mas/yr] Lower Unc  | sy_w4mager1    | W4 (WISE) Magnitude Upper Unc                  |       |             |
| disc.refname    | Discovery Reference                        | pl.msinjlim    | Planet Mass <sup>n</sup> (i) [Jupiter Mass] Limit Flag         | pl.trandeperr2   | Transit Depth Lower Unc. [%]                     | st.masserr2     | Stellar Mass Lower Unc. [Solar mass]                           | sy_pmdec     | Proper Motion (Dec) [mas/yr]           | sy_w4mager2    | W4 (WISE) Magnitude Lower Unc                  |       |             |
| disc.pubdate    | Discovery Publication Date                 | pl.cmasse      | Planet Mass <sup>n</sup> (i) [Earth Mass]                      | pl.trandeplim    | Transit Depth Limit Flag                         | st.masslin      | Stellar Mass Limit Flag  | sy_pmdecerr1 | Proper Motion (Dec) [mas/yr] Upper Unc | sy_gaiamag     | Gaia Magnitude                                 |       |             |
| disc.locale     | Discovery Locale                           | pl.csasserr1   | Planet Mass <sup>n</sup> (i) [Earth Mass] Upper Unc.           | pl.trandur       | Transit Duration [hours]                         | st.met          | Stellar Metallicity [dex]                                      | sy_pmdecerr2 | Proper Motion (Dec) [mas/yr] Lower Unc | sy_gaiamagerr1 | Gaia Magnitude Upper Unc                       |       |             |
| disc.facility   | Discovery Facility                         | pl.csasserr2   | Planet Mass <sup>n</sup> (i) [Earth Mass] Lower Unc.           | pl.trandurer1    | Transit Duration Upper Unc. [hours]              | st.meterr1      | Stellar Metallicity Upper Unc. [dex]                           | sy.dist      | Distance [pc]                          | sy_gaiamagerr2 | Gaia Magnitude Lower Unc                       |       |             |
| disc.telescope  | Discovery Telescope                        | pl.cmassellim  | Planet Mass <sup>n</sup> (i) [Earth Mass] Limit Flag           | pl.trandurer2    | Transit Duration Lower Unc. [hours]              | st.meterr2      | Stellar Metallicity Lower Unc. [dex]                           | sy_disterr1  | Distance [pc] Upper Unc.               | sy_lcmag       | I (Cousins) Magnitude                          |       |             |
| disc.instrument | Discovery Instrument                       | pl.cmassi      | Planet Mass <sup>n</sup> (i) [Jupiter Mass]                    | pl.trandurlim    | Transit Duration Limit Flag                      | st.metlim       | Stellar Metallicity Limit Flag                                 | sy_disterr2  | Distance [pc] Lower Unc                | sy_lcmagerr1   | I (Cousins) Magnitude Upper Unc                |       |             |
| rv.flag         | Detected by Radial Velocity Variations     | pl.cmassjerr1  | Planet Mass <sup>n</sup> (i) [Jupiter Mass] Upper Unc.         | pl.ratodor       | Ratio of Semi-Major Axis to Stellar Radius       | st.metratio     | Stellar Metallicity Ratio                                      | sy_pplx      | Parallax [mas]                         | sy_lcmagerr2   | I (Cousins) Magnitude Lower Unc                |       |             |
| pul.flag        | Detected by Pulsar Timing Variations       | pl.cmassjerr2  | Planet Mass <sup>n</sup> (i) [Jupiter Mass] Lower Unc.         | pl.ratodorerr1   | Ratio of Semi-Major Axis to Stellar Radius Upper | st.lum          | Stellar Luminosity [log(Solar)]                                | sy_pxerr1    | Parallax [mas] Upper Unc.              | sy_imag        | TESS Magnitude                                 |       |             |
| ptv.flag        | Detected by Pulsation Timing Variations    | pl.cmassjlim   | Planet Mass <sup>n</sup> (i) [Jupiter Mass] Limit Flag         | pl.ratodorerr2   | Ratio of Semi-Major Axis to Stellar Radius Lower | st.lumerr1      | Stellar Luminosity Upper Unc. [log(Solar)]                     | sy_pxerr2    | Parallax [mas] Lower Unc.              | sy_imagerr1    | TESS Magnitude Upper Unc                       |       |             |
| tran.flag       | Detected by Transits                       | pl.bnasse      | Planet Mass or Mass <sup>n</sup> (i) [Earth Mass]              | pl.ratodlim      | Ratio of Semi-Major Axis to Stellar Radius Limit | st.lumerr2      | Stellar Luminosity Lower Unc. [log(Solar)]                     | sy_bmag      | B (Johnson) Magnitude                  | sy_imagerr2    | TESS Magnitude Lower Unc                       |       |             |
| ast.flag        | Detected by Astrometric Variations         | pl.bnasserr1   | Planet Mass or Mass <sup>n</sup> (i) [Earth Mass] Upper Unc.   | pl.ratodor       | Ratio of Planet to Stellar Radius                | st.lumlim       | Stellar Luminosity Limit Flag                                  | sy_bmagerr1  | B (Johnson) Magnitude Upper Unc        | sy_kepmag      | Kepler Magnitude                               |       |             |
| obm.flag        | Detected by Orbital Brightness Modulations | pl.bnasserr2   | Planet Mass or Mass <sup>n</sup> (i) [Earth Mass] Lower Unc.   | pl.ratodorerr1   | Ratio of Planet to Stellar Radius Upper Unc.     | st.logg         | Stellar Surface Gravity [log(10cm/s <sup>2</sup> )]            | sy_bmagerr2  | B (Johnson) Magnitude Lower Unc.       | sy_kepmagerr1  | Kepler Magnitude Upper Unc                     |       |             |
| micro.flag      | Detected by Microlensing                   | pl.bnassellim  | Planet Mass or Mass <sup>n</sup> (i) [Earth Mass] Limit Flag   | pl.ratodorerr2   | Ratio of Planet to Stellar Radius Lower Unc.     | st.logger1      | Stellar Surface Gravity Upper Unc. [log(10cm/s <sup>2</sup> )] | sy_vmag      | V (Johnson) Magnitude                  | sy_kepmagerr2  | Kepler Magnitude Lower Unc                     |       |             |
| etv.flag        | Detected by Eclipse Timing Variations      | pl.bnassj      | Planet Mass or Mass <sup>n</sup> (i) [Jupiter Mass]            | pl.ratotrim      | Ratio of Planet to Stellar Radius Limit Flag     | st.logger2      | Stellar Surface Gravity Lower Unc. [log(10cm/s <sup>2</sup> )] | sy_vmagerr1  | V (Johnson) Magnitude Upper Unc        | rowupdate      | Date of Last Update                            |       |             |
| ima.flag        | Detected by Imaging                        | pl.bnassjerr1  | Planet Mass or Mass <sup>n</sup> (i) [Jupiter Mass] Upper Unc. | pl.occdsep1      | Occultation Depth Upper Unc. [%]                 | st.loglim       | Stellar Surface Gravity Limit Flag                             | sy_vmagerr2  | V (Johnson) Magnitude Lower Unc        | pl_pubdate     | Planetary Parameter Reference Publication Date |       |             |
| dkin.flag       | Detected by Disk Kinematics                | pl.bnassjerr2  | Planet Mass or Mass <sup>n</sup> (i) [Jupiter Mass] Lower Unc. | pl.occdsep2      | Occultation Depth Lower Unc. [%]                 | st.age          | Stellar Age [Gyr]  | sy_imag      | J (2MASS) Magnitude                    | releasedate    | Release Date                                   |       |             |
| soltyp          | Software Type                              | pl.bnassjlim   | Planet Mass or Mass <sup>n</sup> (i) [Jupiter Mass] Limit Flag | pl.occdseperr1   | Occultation Depth Lower Unc. [%]                 | st.ageerr1      | Stellar Age Upper Unc. [Gyr]                                   | sy_imagerr1  | J (2MASS) Magnitude Upper Unc          | pl_notes       | Number of Notes                                |       |             |
| pl.controv.flag | Controversial Flag                         | pl.bnassprov   | Planet Mass or Mass <sup>n</sup> (i) [Jupiter Mass] Provenance | pl.occdlelim     | Occultation Depth Limit Flag                     | st.ageerr2      | Stellar Age Lower Unc. [Gyr]                                   | sy_imagerr2  | J (2MASS) Magnitude Lower Unc          | st_phot        | Number of Photometry Time Series               |       |             |
| pl.refname      | Planetary Parameter Reference              | pl.dens        | Planet Density [g/cm <sup>3</sup> ]                            | pl.orbitper      | Epoch of Periastron [days]                       | st.agelim       | Stellar Age Limit Flag   | sy_imag      | H (2MASS) Magnitude                    | st_nrv         | Number of Radial Velocity Time Series          |       |             |
| pl.orber        | Orbital Period [days]                      | pl.denserr1    | Planet Density Upper Unc. [g/cm <sup>3</sup> ]                 | pl.orbitpererr1  | Epoch of Periastron Upper Unc. [days]            | st.dens         | Stellar Density [g/cm <sup>3</sup> ]                           | sy_imagerr1  | H (2MASS) Magnitude Upper Unc          | st_nspec       | Number of Stellar Spectra Measurements         |       |             |
| pl.orbererr1    | Orbital Period Upper Unc. [days]           | pl.denserr2    | Planet Density Lower Unc. [g/cm <sup>3</sup> ]                 | pl.orbitpererr2  | Epoch of Periastron Lower Unc. [days]            | st.denserr1     | Stellar Density Upper Unc. [g/cm <sup>3</sup> ]                | sy_imagerr2  | H (2MASS) Magnitude Lower Unc          | pl_nespec      | Number of Eclipse Spectra                      |       |             |
| pl.orbererr2    | Orbital Period Lower Unc. [days]           | pl.denslim     | Planet Density Limit Flag                                      | pl.orbitperlim   | Epoch of Periastron Limit Flag                   | st.denserr2     | Stellar Density Lower Unc. [g/cm <sup>3</sup> ]                | sy_kmag      | Ks (2MASS) Magnitude                   | pl_intranspec  | Number of Transmission Spectra                 |       |             |
| pl.orberlim     | Orbital Period Limit Flag                  | pl.orbecen     | Eccentricity   | pl.orberper      | Argument of Periastron [deg]                     | st.denslim      | Stellar Density Limit Flag                                     | sy_kmagerr1  | Ks (2MASS) Magnitude Upper Unc         | pl_ndispec     | Number of Direct Imaging Spectra               |       |             |
| pl.bnsmax       | Orbit Semi-Major Axis [au]                 | pl.orbecenerr1 | Eccentricity Upper Unc.  | pl.orbererr1     | Argument of Periastron Upper Unc. [deg]          | st.vsin         | Stellar Rotational Velocity [km/s]                             | sy_kmagerr2  | Ks (2MASS) Magnitude Lower Unc         |                |  |       |             |
| pl.bnsmaxerr1   | Orbit Semi-Major Axis Upper Unc. [au]      | pl.orbecenerr2 | Eccentricity Lower Unc.  | pl.orberpererr2  | Argument of Periastron Lower Unc. [deg]          | st.vsinerr1     | Stellar Rotational Velocity [km/s] Upper Unc.                  | sy_umag      | u (Sloan) Magnitude                    |                |  |       |             |
| pl.bnsmaxerr2   | Orbit Semi-Major Axis Lower Unc. [au]      | pl.orbecenlim  | Eccentricity Limit Flag  | pl.orberperlim   | Argument of Periastron Limit Flag                | st.vsinerr2     | Stellar Rotational Velocity [km/s] Lower Unc.                  | sy_umagerr1  | u (Sloan) Magnitude Upper Unc          |                |  |       |             |
| pl.bnsmaxlim    | Orbit Semi-Major Axis Limit Flag           | pl.insol       | Insolation Flux [Earth Flux]                                   | pl.rvamp         | Radial Velocity Amplitude [m/s]                  | st.vsinlim      | Stellar Rotational Velocity Limit Flag                         | sy_umagerr2  | u (Sloan) Magnitude Lower Unc.         |                |  |       |             |
| pl.rade         | Planet Radius [Earth Radius]               | pl.insolerr1   | Insolation Flux Upper Unc. [Earth Flux]                        | pl.rvamperr1     | Radial Velocity Amplitude Upper Unc. [m/s]       | st.rotpl        | Stellar Rotational Period [days]                               | sy_imag      | g (Sloan) Magnitude                    |                |  |       |             |
| pl.raeerr1      | Planet Radius Upper Unc. [Earth Radius]    | pl.insolerr2   | Insolation Flux Lower Unc. [Earth Flux]                        | pl.rvamperr2     | Radial Velocity Amplitude Lower Unc. [m/s]       | st.rotper1      | Stellar Rotational Period [days] Upper Unc.                    | sy_imagerr1  | g (Sloan) Magnitude Upper Unc          |                |  |       |             |
| pl.raeerr2      | Planet Radius Lower Unc. [Earth Radius]    | pl.insolim     | Insolation Flux Limit Flag                                     | pl.rvamplim      | Radial Velocity Amplitude Limit Flag             | st.rotper2      | Stellar Rotational Period [days] Lower Unc.                    | sy_imagerr2  | g (Sloan) Magnitude Lower Unc.         |                |  |       |             |
| pl.raelim       | Planet Radius Limit Flag                   | pl.leqt        | Equilibrium Temperature [K]                                    | pl.projobliq     | Projected Obliquity [deg]                        | st.rotplim      | Stellar Rotational Period Limit Flag                           | sy_imag      | r (Sloan) Magnitude                    |                |  |       |             |
| pl.radi         | Planet Radius [Jupiter Radius]             | pl.leqterr1    | Equilibrium Temperature Upper Unc. [K]                         | pl.projobliqerr1 | Projected Obliquity Upper Unc. [deg]             | st.radv         | Systemic Radial Velocity [km/s]                                | sy_imagerr1  | r (Sloan) Magnitude Upper Unc.         |                |  |       |             |
| pl.rajerr1      | Planet Radius Upper Unc. [Jupiter Radius]  | pl.leqterr2    | Equilibrium Temperature Lower Unc. [K]                         | pl.projobliqerr2 | Projected Obliquity Lower Unc. [deg]             | st.radverr1     | Systemic Radial Velocity Upper Unc. [km/s]                     | sy_imagerr2  | r (Sloan) Magnitude Lower Unc.         |                |  |       |             |
| pl.rajerr2      | Planet Radius Lower Unc. [Jupiter Radius]  | pl.leqtm       | Equilibrium Temperature Limit Flag                             | pl.projobliqlim  | Projected Obliquity Limit Flag                   | st.radverr2     | Systemic Radial Velocity Lower Unc. [km/s]                     | sy_imag      | i (Sloan) Magnitude                    |                |  |       |             |
| pl.rajdlim      | Planet Radius Limit Flag                   | pl.orbind      | Inclination [deg]  | pl.trueobliq     | True Obliquity [deg]                             | st.radvlim      | Systemic Radial Velocity Limit Flag                            | sy_imagerr1  | j (Sloan) Magnitude Upper Unc.         |                |  |       |             |
| pl.masse        | Planet Mass [Earth Mass]                   | pl.orbinderr1  | Inclination Upper Unc. [deg]                                   | pl.trueobliqerr1 | True Obliquity Upper Unc. [deg]                  | sy_refname      | System Parameter Reference                                     | sy_imagerr2  | i (Sloan) Magnitude Lower Unc.         |                |  |       |             |

- Names and IDs
- Star System Composition
- Planet Discovery Details
- Detection Flags
- Planet Parameters
- System Data
- Position
- Photometry
- Dates



# History of Exoplanet Hunting



## 1992 First Exoplanets

The first confirmed exoplanets were discovered in 1992 by astronomers Aleksander Wolszczan and Dale Frail.

## 2009 Kepler Launches

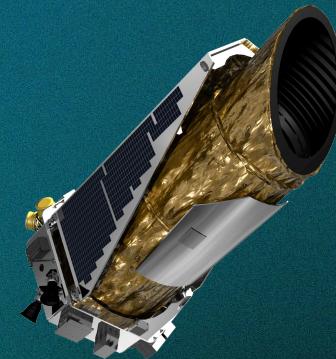
Launched on March 7, 2009, the Kepler space telescope was designed to discover Earth-sized planets in other stars' habitable zones.

## 2014 Kepler “K2” Mission

Following a mechanical failure, Kepler begins a new mission after taking advantage of solar winds to help stabilize the telescope's pointing.

## 2018 TESS Launches

The Transiting Exoplanet Survey Satellite, Kepler's successor, launches into space to begin its mission. 2018 also marks the end of the Kepler mission.



# First Query

What are the 15 telescopes that have positively identified the most exoplanets?

```
nasa.groupby('disc_telescope')['rowid'].count().sort_values(ascending=False).head(15)
```

|                                     |       |
|-------------------------------------|-------|
| 0.95 m Kepler Telescope             | 28757 |
| Canon 200mm f/1.8L                  | 1749  |
| 0.1 m TESS Telescope                | 1469  |
| Multiple Telescopes                 | 680   |
| 10 m Keck I Telescope               | 626   |
| 3.6 m ESO Telescope                 | 415   |
| 1.3 m Warsaw University Telescope   | 352   |
| 0.18 m Takahashi Epsilon Astrograph | 294   |
| 1.6 m wide-field telescope          | 270   |
| 1.93 m Telescope                    | 162   |
| 1.2 m Leonhard Euler Telescope      | 156   |
| 3.0 m C. Donald Shane Telescope     | 132   |
| 0.27 m CoRoT Telescope              | 130   |
| 3.9 m Anglo-Australian Telescope    | 122   |
| Mamiya 645 80mm f/1.9               | 119   |

|                                     |       |
|-------------------------------------|-------|
| 0.95 m Kepler Telescope             | 28757 |
| Canon 200mm f/1.8L                  | 1749  |
| 0.1 m TESS Telescope                | 1469  |
| Multiple Telescopes                 | 680   |
| 10 m Keck I Telescope               | 626   |
| 3.6 m ESO Telescope                 | 415   |
| 1.3 m Warsaw University Telescope   | 352   |
| 0.18 m Takahashi Epsilon Astrograph | 294   |
| 1.6 m wide-field telescope          | 270   |
| 1.93 m Telescope                    | 162   |
| 1.2 m Leonhard Euler Telescope      | 156   |
| 3.0 m C. Donald Shane Telescope     | 132   |
| 0.27 m CoRoT Telescope              | 130   |
| 3.9 m Anglo-Australian Telescope    | 122   |
| Mamiya 645 80mm f/1.9               | 119   |

# CANON 200MM F/1.8L



# CANON 200MM F/1.8L

*“THE EYE OF SAURON”*

WHO IS USING THIS?



# CANON 200MM F/1.8L

*“THE EYE OF SAURON”*

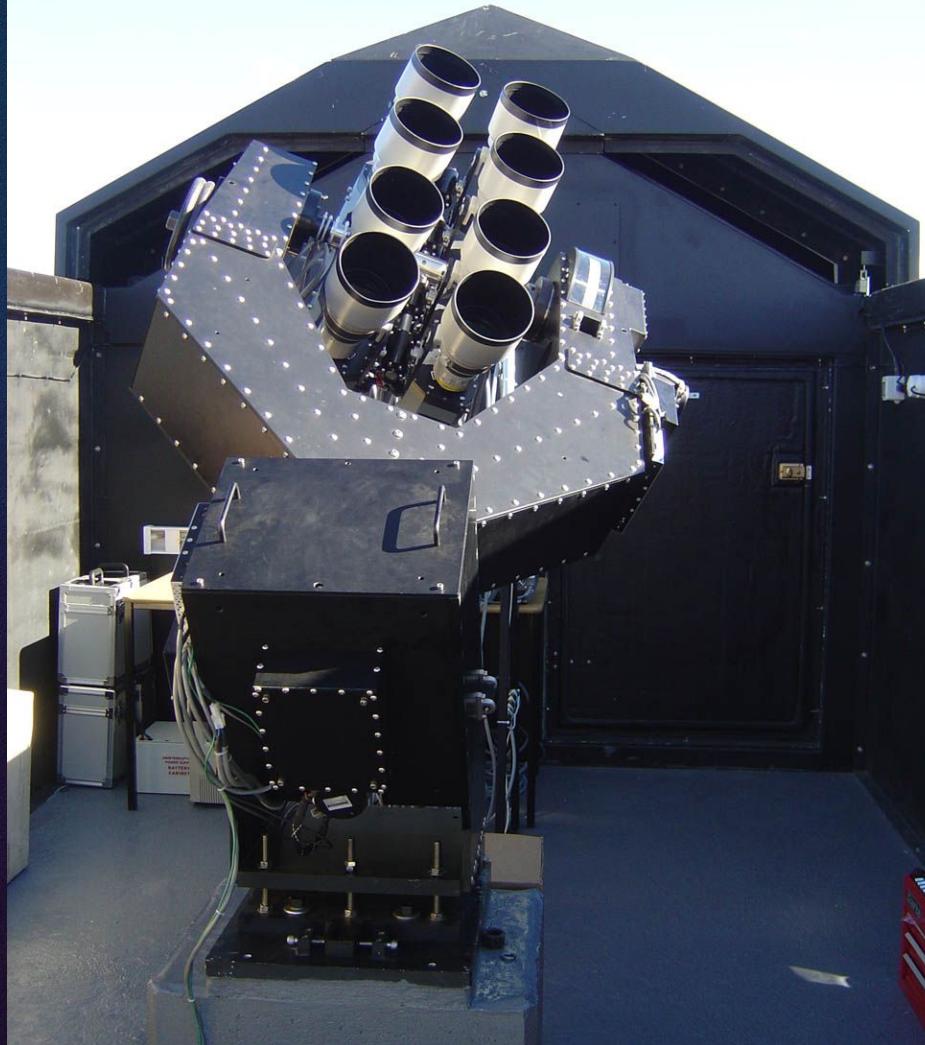
|                 |     |
|-----------------|-----|
| HATNet          | 512 |
| SuperWASP       | 955 |
| SuperWASP-North | 21  |
| SuperWASP-South | 155 |
| WASP-South      | 39  |
| XO              | 67  |



# CANON 200MM F/1.8L

*“THE EYE OF SAURON”*

|                 |     |
|-----------------|-----|
| HATNet          | 512 |
| SuperWASP       | 955 |
| SuperWASP-North | 21  |
| SuperWASP-South | 155 |
| WASP-South      | 39  |
| XO              | 67  |

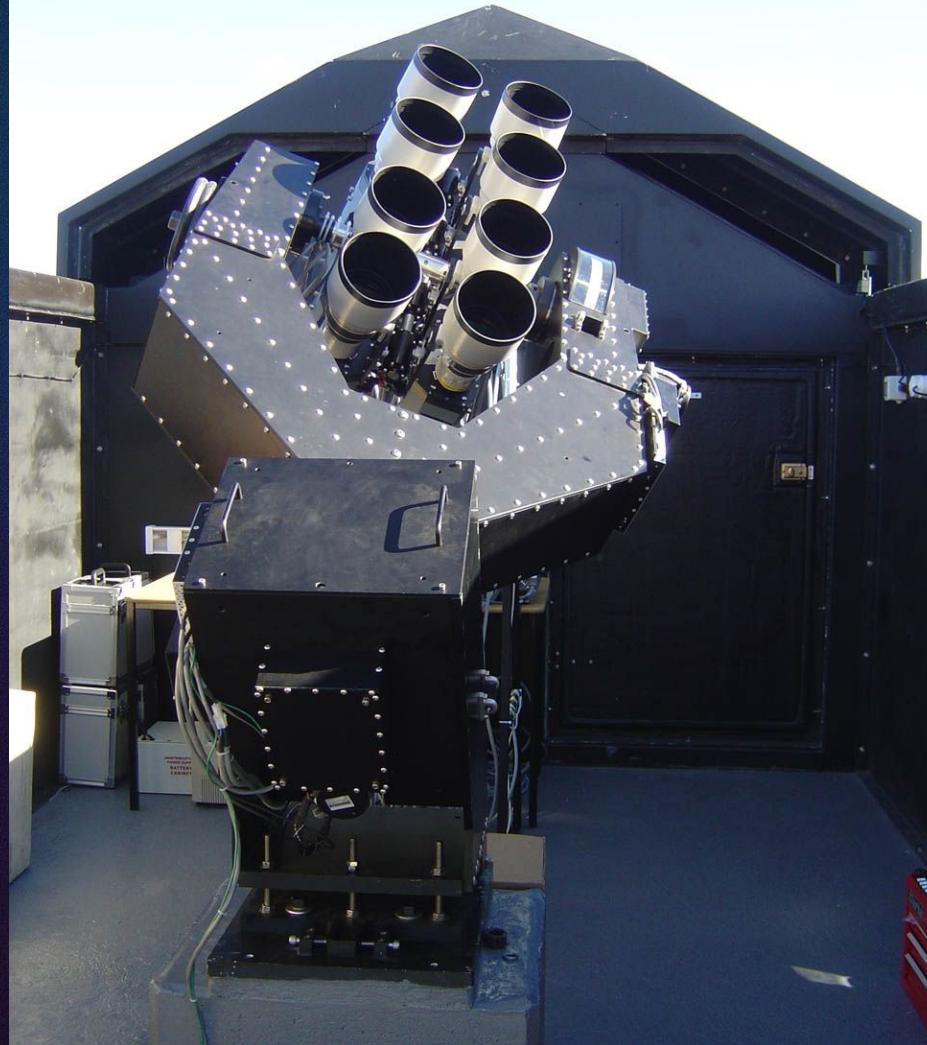


# CANON 200MM F/1.8L

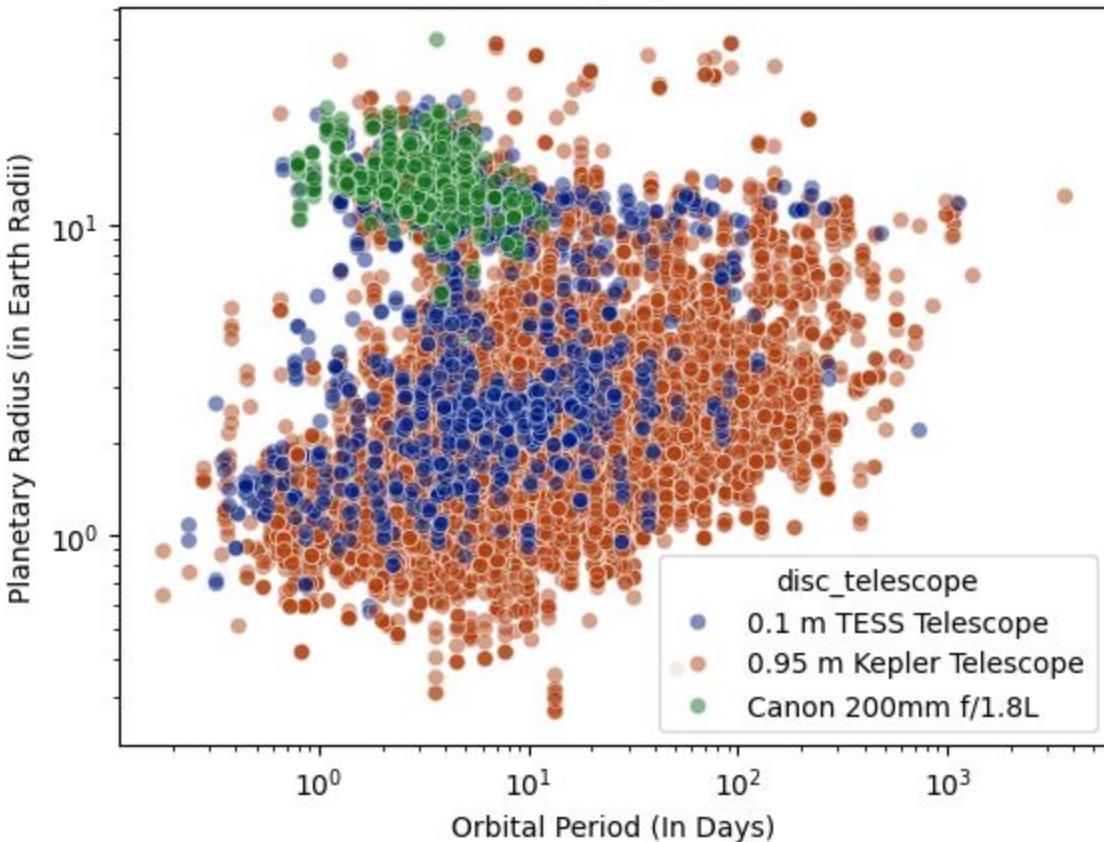
*“THE EYE OF SAURON”*

Average Planetary Radius  
in Earth Radii

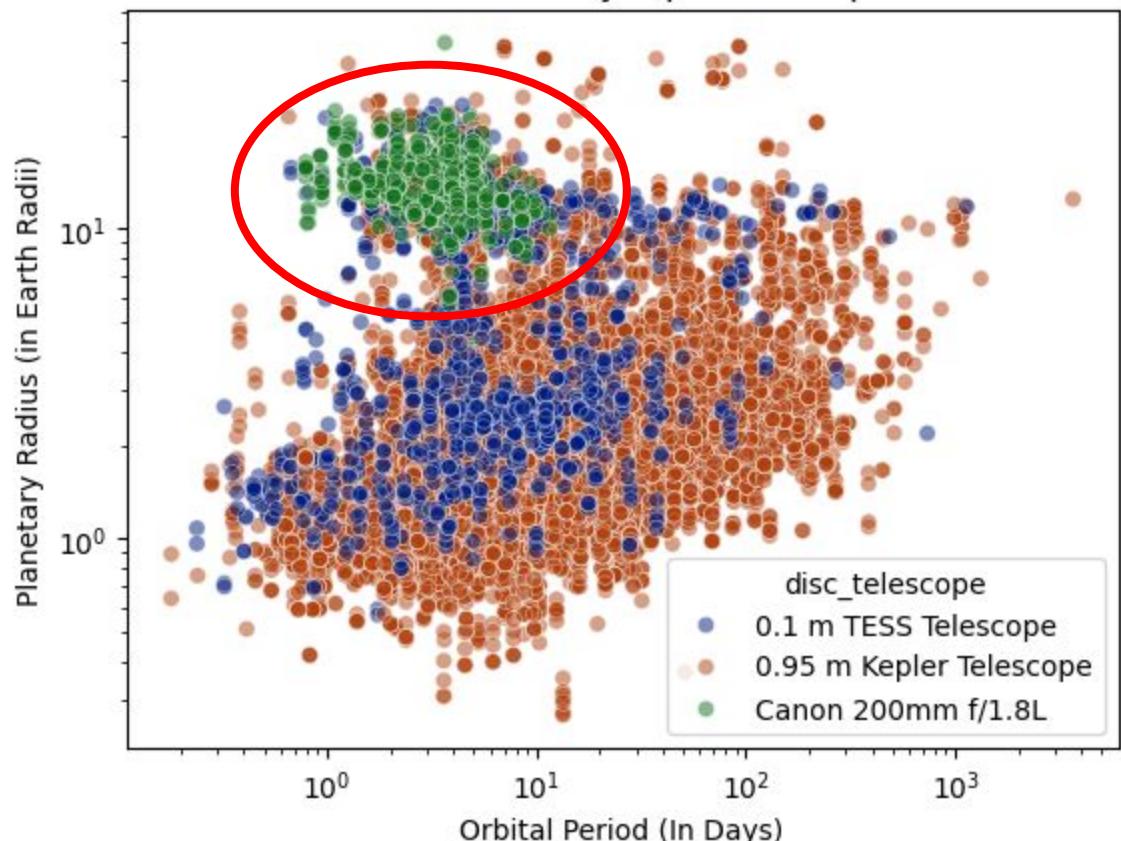
|                  |      |
|------------------|------|
| Canon 200MM      | 14.2 |
| Other Telescopes | 4.9  |

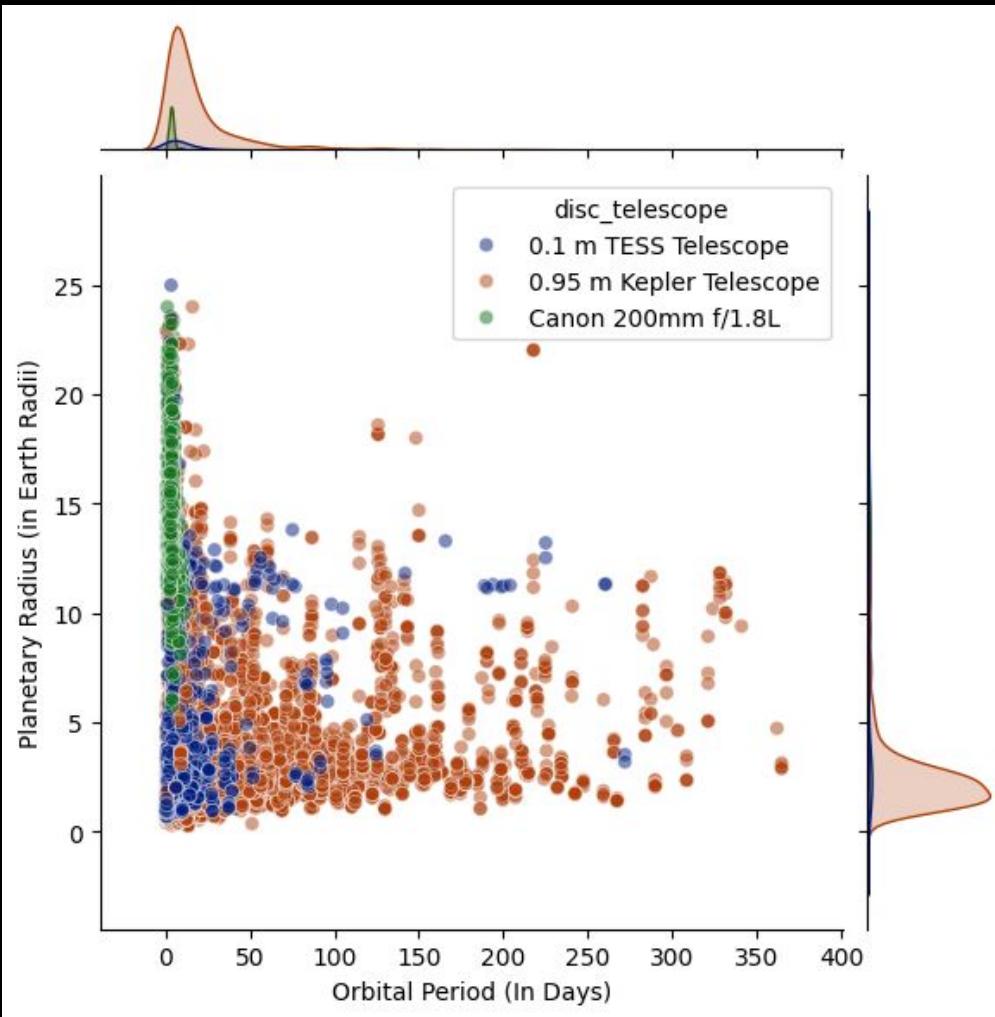


### Planets Found by Top 3 Telescopes



## Planets Found by Top 3 Telescopes





# Detection Methods

What are the 10 most common discovery methods?

```
nasa.groupby('discoverymethod')['rowid'].count().sort_values(ascending=False).head(10)
```

|                               |       |
|-------------------------------|-------|
| Transit                       | 32838 |
| Radial Velocity               | 2564  |
| Microlensing                  | 671   |
| Imaging                       | 147   |
| Transit Timing Variations     | 140   |
| Eclipse Timing Variations     | 24    |
| Orbital Brightness Modulation | 21    |
| Pulsar Timing                 | 13    |
| Astrometry                    | 3     |
| Pulsation Timing Variations   | 2     |

|                               |       |
|-------------------------------|-------|
| Transit                       | 32838 |
| Radial Velocity               | 2564  |
| Microlensing                  | 671   |
| Imaging                       | 147   |
| Transit Timing Variations     | 140   |
| Eclipse Timing Variations     | 24    |
| Orbital Brightness Modulation | 21    |
| Pulsar Timing                 | 13    |
| Astrometry                    | 3     |
| Pulsation Timing Variations   | 2     |

# Detection methods

## Transit Method

Detected by the dip in light that occurs when a planet passes in between it's star and us.

## Radial Velocity

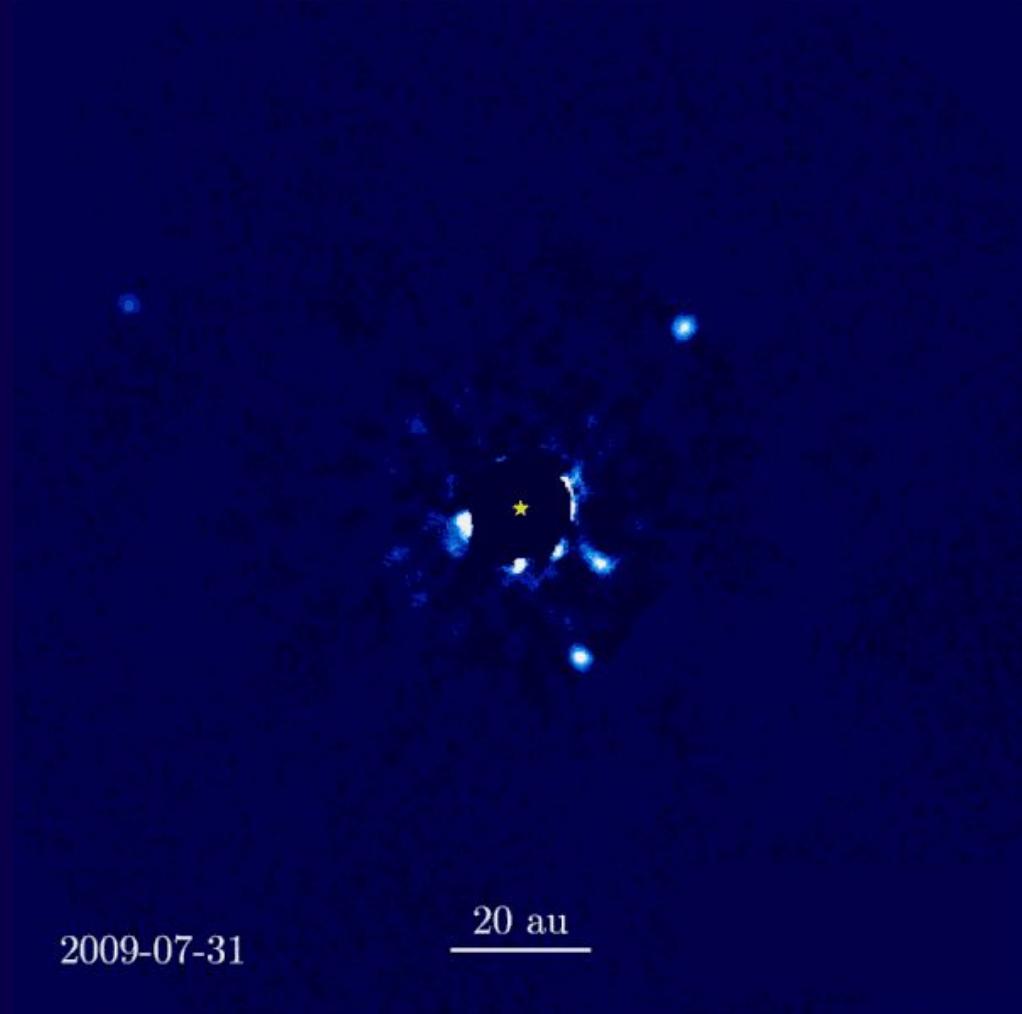
Detected by the gravitational wobble the planet causes on it's host star.

## Gravitational Microlensing

Uses the gravitational lensing when a star passes in front of another to detect faraway planets.

## Direct Imaging

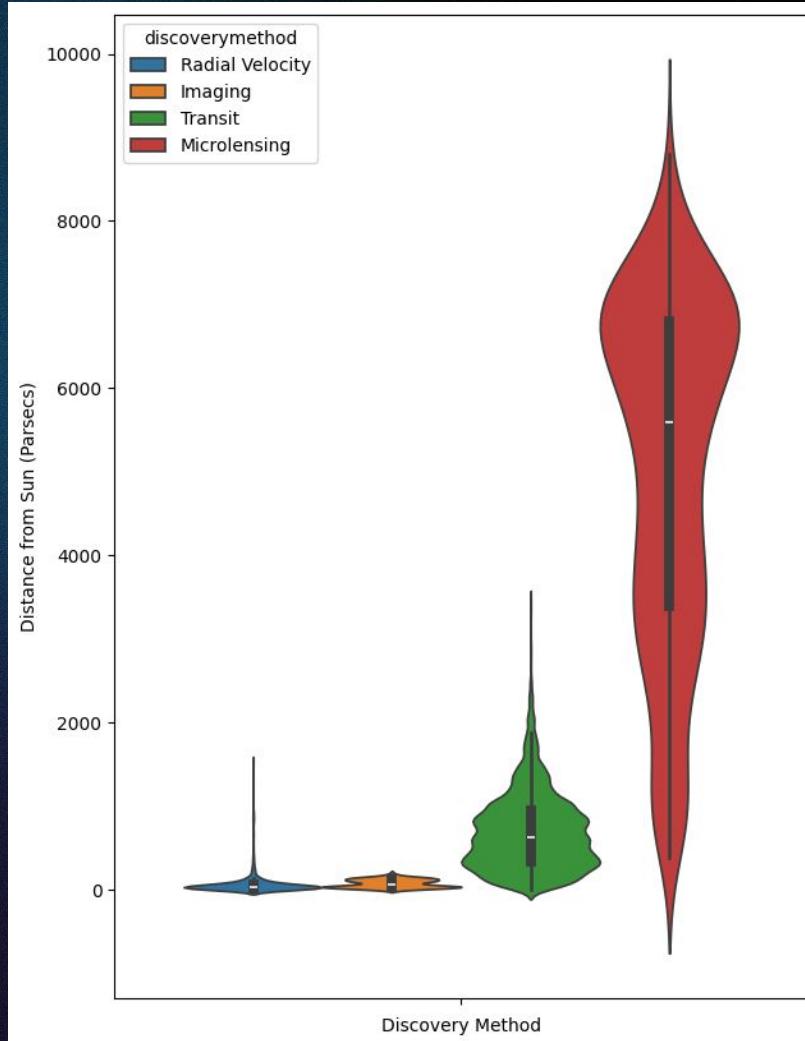
Directly imaging exoplanets by blocking out the light from the host star.



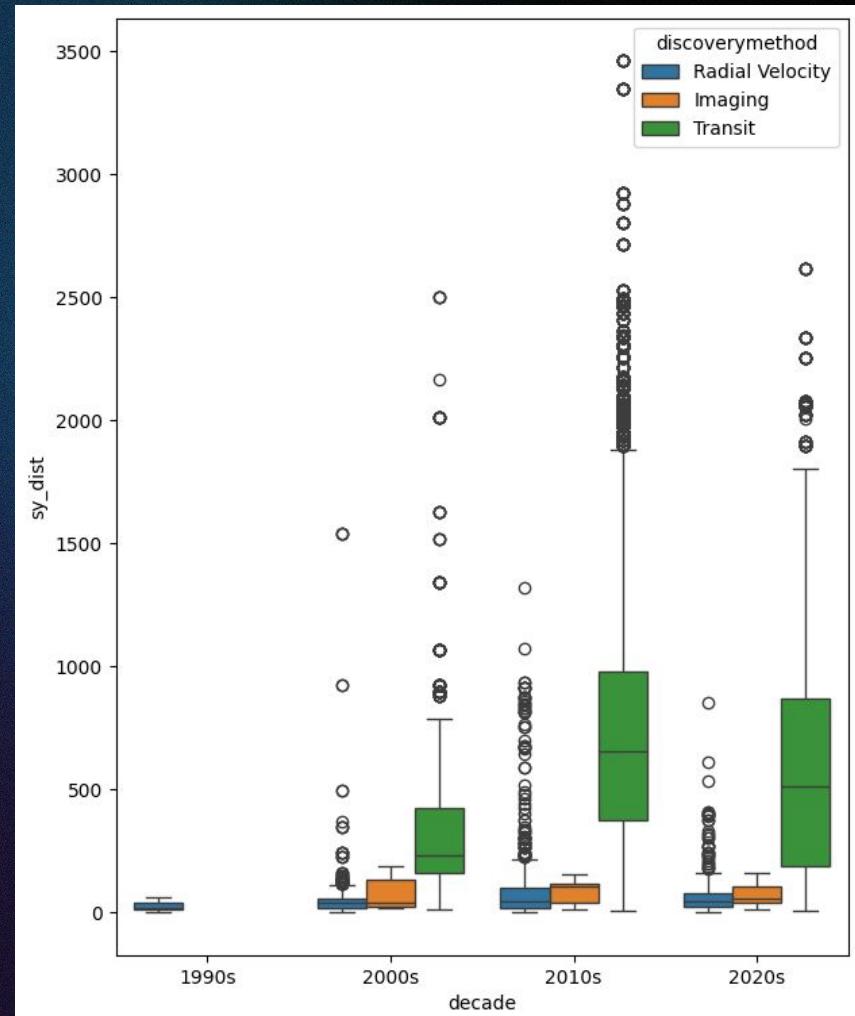
2009-07-31

20 au

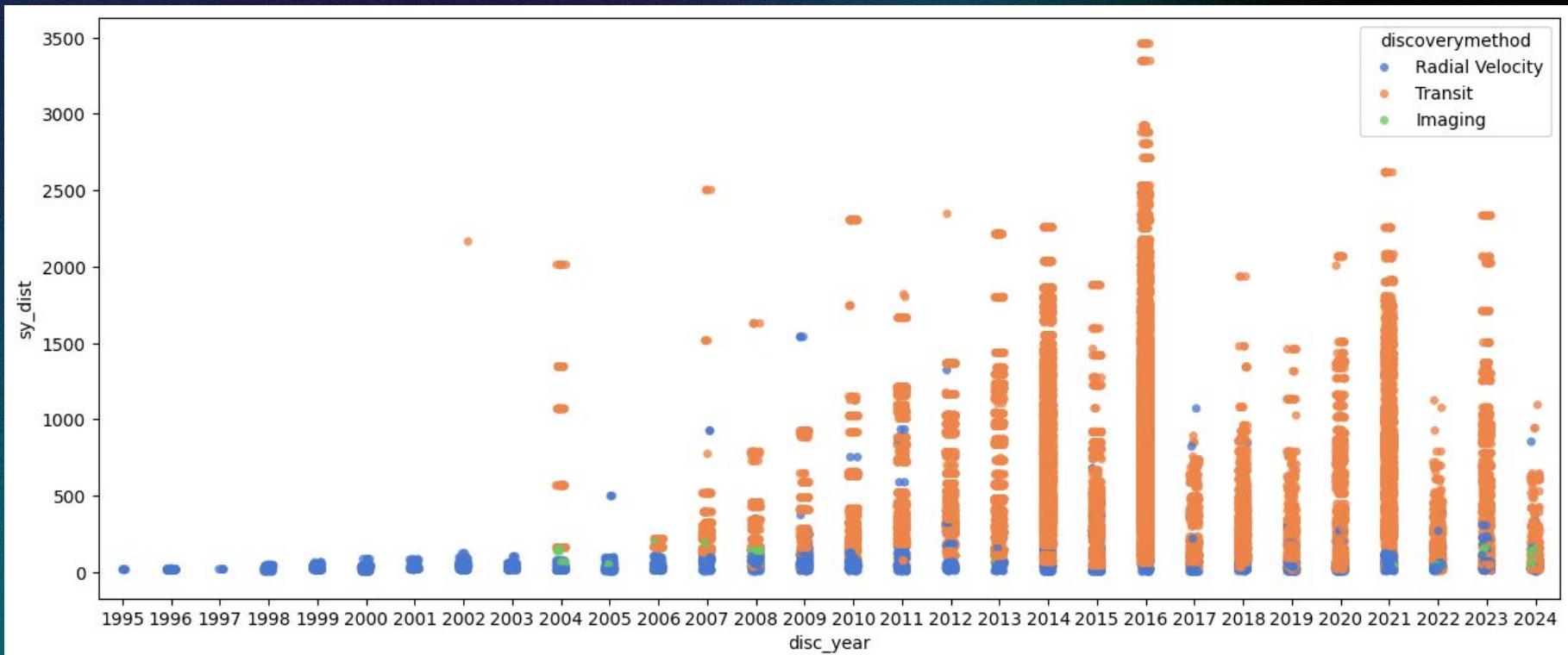
# Distance from Earth By Method



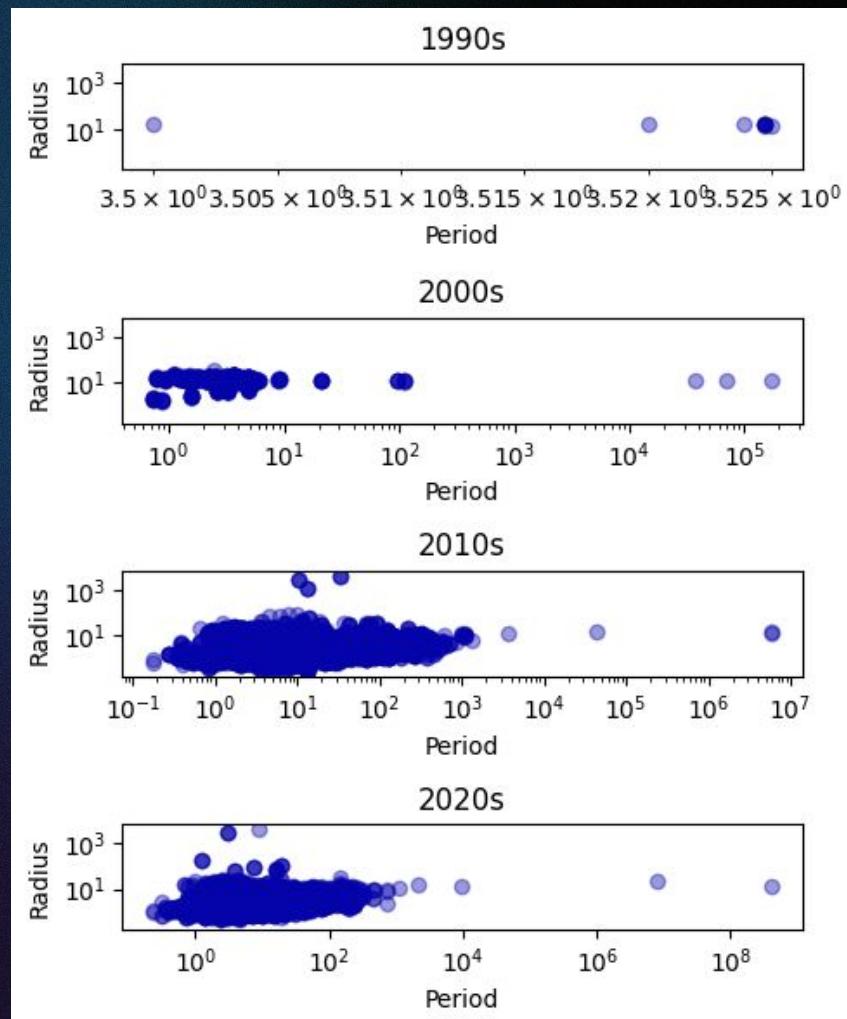
# Distance from Earth By Method



# Distance from Earth By Method



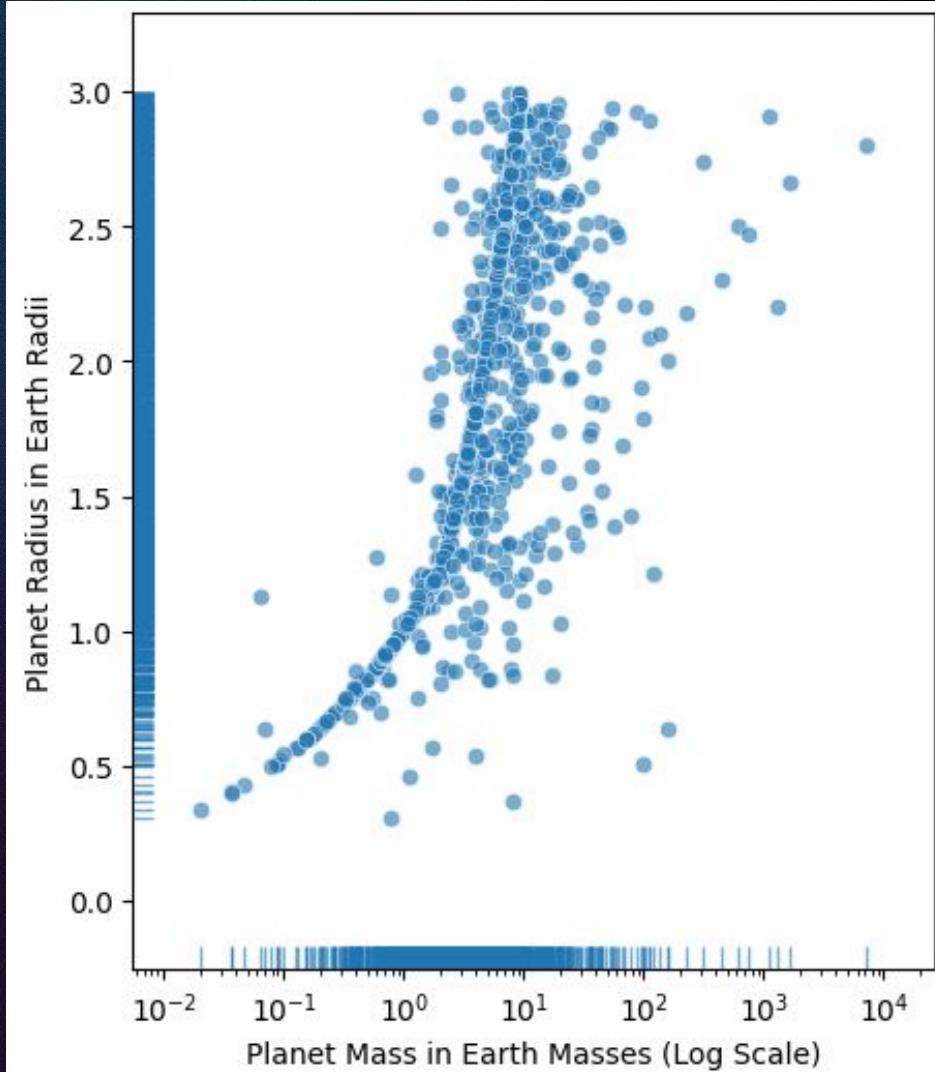
# Planets Discovered By Decade



# Earth Sized Planets (ish)

Planets that are less than 3x the radius of Earth

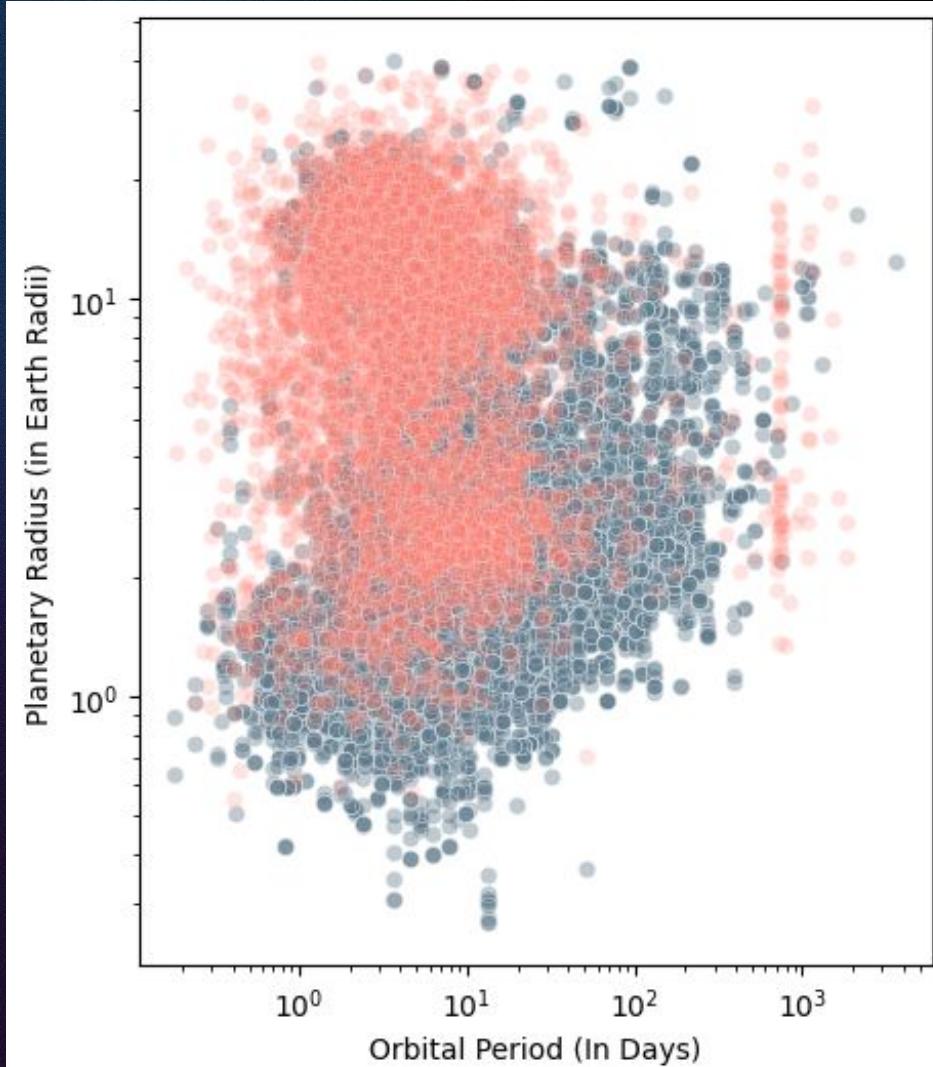
**3105**



# TESS Candidates

Possible planets identified by TESS.

# 7351



# WHAT'S NEXT?

Finding Earth-like exoplanets that could harbor life is priority of the 2020 decadal survey.

They have recommended we develop a JWST-sized telescope capable of detecting biosignatures in the atmospheres of Earth-sized exoplanets, targeted to launch by the mid-2040s.

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