Package 'exoplanetdata'

July 11, 2026

Title Exoplanet Datasets for Teaching Introductory Statistics

Version 0.1.0

Description Tidied datasets of confirmed exoplanets and their host stars, retrieved from NASA's Exoplanet Archive via the 'REXoplanets' package. Column names have been simplified for classroom use, with units baked into names where ambiguous. Intended as a companion dataset for introductory statistics teaching in the spirit of the 'ModernDive' textbook.

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Encoding UTF-8

LazyData true

LazyDataCompression xz

Depends R (>= 4.1)

Suggests REXoplanets, dplyr, readr, tibble, purrr, roxygen2

RoxygenNote 7.3.3

URL https://github.com/moderndive/exoplanetdata, https://moderndive.github.io/exoplanetdata/

BugReports https://github.com/moderndive/exoplanetdata/issues

NeedsCompilation no

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Repository CRAN

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Contents

`planets` *Confirmed Exoplanets*

Description

One row per confirmed exoplanet from NASA's Exoplanet Archive Planetary Systems Composite Parameters (`pscomppars`) table. Each row carries the archive's best composite parameter values, with the planet's host star properties already merged in. Column names have been simplified for classroom use; the original NASA short name for each column is listed in the `archive_name` field of the data dictionary (`system.file("extdata", "data_dictionary_planets.csv", package = "exoplanetdata")`).

Usage

```
planets
```

Format

A data frame with 6278 rows and 28 variables:

planet_name (character) Planet name most commonly used in the literature.

host_name (character) Stellar name most commonly used in the literature.

n_stars (numeric) Number of gravitationally bound stars in the planetary system.

n_planets (numeric) Number of confirmed planets in the planetary system.

discovery_method (factor) Method by which the planet was first identified (e.g. Transit, Radial Velocity).

discovery_year (integer) Year the planet was discovered.

discovery_facility (character) Name of the facility making the discovery observations.

orbital_period_days (numeric, days) Time the planet takes to complete one orbit around its host (system).

semi_major_axis_au (numeric, au) Longest radius of the elliptic orbit; for microlensing/imaging detections, the projected sky-plane separation.

eccentricity (numeric) Amount by which the orbit deviates from a perfect circle (0 = circular).

inclination_deg (numeric, deg) Angle of the orbit plane relative to the plane perpendicular to Earth's line of sight.

radius_earth (numeric, Earth radii) Planet radius measured in units of Earth's radius.

radius_jupiter (numeric, Jupiter radii) Planet radius measured in units of Jupiter's radius.

mass_earth (numeric, Earth masses) Best mass estimate (Mass, M*sin(i)/sin(i), or M*sin(i)) in Earth masses.

mass_jupiter (numeric, Jupiter masses) Best mass estimate (Mass, M*sin(i)/sin(i), or M*sin(i)) in Jupiter masses.

density_g_cm3 (numeric, g/cm^3) Planet mass per unit volume.

eq_temp_k (numeric, K) Equilibrium temperature assuming a black-body planet heated by its host star.

insolation_earth (numeric, Earth flux) Stellar flux at the planet relative to Earth's solar flux.

star_spec_type (character) Morgan-Keenan spectral classification of the host star.

star_temp_k (numeric, K) Black-body temperature emitting the same total electromagnetic radiation as the star.

star_radius_solar (numeric, Solar radii) Stellar radius in units of the Sun's radius.

star_mass_solar (numeric, Solar masses) Stellar mass in units of the Sun's mass.

star_metallicity_dex (numeric, dex) Metal content of the stellar photosphere relative to hydrogen.

star_log_g (numeric, log10(cm/s^2)) Gravitational acceleration at the stellar surface (log10).

star_age_gyr (numeric, Gyr) Age of the host star in billions of years.

ra_deg (numeric, deg) Right ascension of the planetary system in decimal degrees.

dec_deg (numeric, deg) Declination of the planetary system in decimal degrees.

distance_pc (numeric, pc) Distance to the planetary system in parsecs.

Source

NASA Exoplanet Archive Planetary Systems columns documentation: https://exoplanetarchive.ipac.caltech.edu/docs/API_PS_columns.html. Retrieved via the **REXoplanets** package.

`stars` *Stellar Hosts (Reference-Level)*

Description

Reference-level stellar parameter data from NASA's Exoplanet Archive `stellarhosts` table. Unlike `planets`, this table contains MANY rows per host star (one per published parameter solution), so it is the right table for studying the spread of published values for a single star but NOT for one-row-per-star analyses. For most introductory analyses, the host star's "best" parameters are already merged into `planets` - reach for `stars` only when you need uncertainties, alternative solutions, or full photometry.

Usage

```
stars
```

Format

A data frame with 47558 rows and 134 variables:

host_name (character) Stellar name most commonly used in the literature.

hd_id (character) Henry Draper Catalog identifier.

hip_id (character) Hipparcos Catalog identifier.

tic_id (character) TESS Input Catalog identifier.

ra_deg (numeric, deg) Right ascension of the planetary system in decimal degrees.

ra_sexagesimal (character) Right ascension in sexagesimal hh:mm:ss notation.

dec_deg (numeric, deg) Declination of the planetary system in decimal degrees.

dec_sexagesimal (character) Declination in sexagesimal dd:mm:ss notation.

galactic_lon_deg (numeric, deg) Galactic longitude of the planetary system.

galactic_lat_deg (numeric, deg) Galactic latitude of the planetary system.

ecliptic_lon_deg (numeric, deg) Ecliptic longitude of the planetary system.

ecliptic_lat_deg (numeric, deg) Ecliptic latitude of the planetary system.

mag_i_cousins (logical, mag) Apparent brightness in the I (Cousins) band.

mag_i_cousins_upper_err (logical, mag) Upper (positive) 1-sigma uncertainty on sy_icmag.

mag_i_cousins_lower_err (logical, mag) Lower (negative) 1-sigma uncertainty on sy_icmag.

temperature_k (numeric, K) Black-body temperature emitting the same total electromagnetic radiation as the star.

temperature_k_upper_err (numeric, K) Upper (positive) 1-sigma uncertainty on st_teff.

temperature_k_lower_err (numeric, K) Lower (negative) 1-sigma uncertainty on st_teff.

temperature_k_limit_flag (numeric) Limit flag for st_teff: 1 = upper limit, -1 = lower limit, 0 = a measured value.

metallicity_dex (numeric, dex) Metal content of the stellar photosphere relative to hydrogen.

metallicity_dex_upper_err (numeric, dex) Upper (positive) 1-sigma uncertainty on st_met.

metallicity_dex_lower_err (numeric, dex) Lower (negative) 1-sigma uncertainty on st_met.

metallicity_dex_limit_flag (numeric) Limit flag for st_met: 1 = upper limit, -1 = lower limit, 0 = a measured value.

radial_velocity_km_s (numeric, km/s) Star's velocity along the line of sight from Earth.

radial_velocity_km_s_upper_err (numeric, km/s) Upper (positive) 1-sigma uncertainty on st_radv.

radial_velocity_km_s_lower_err (numeric, km/s) Lower (negative) 1-sigma uncertainty on st_radv.

radial_velocity_km_s_limit_flag (numeric) Limit flag for st_radv: 1 = upper limit, -1 = lower limit, 0 = a measured value.

v_sin_i_km_s (numeric, km/s) Equatorial rotational velocity multiplied by sin(inclination).

v_sin_i_km_s_upper_err (numeric, km/s) Upper (positive) 1-sigma uncertainty on st_vsin.

v_sin_i_km_s_lower_err (numeric, km/s) Lower (negative) 1-sigma uncertainty on st_vsin.

v_sin_i_km_s_limit_flag (numeric) Limit flag for st_vsin: 1 = upper limit, -1 = lower limit, 0 = a measured value.

luminosity_log_solar (numeric, log10(L_sun)) Energy emitted per unit time, in solar luminosities (log10).

luminosity_log_solar_upper_err (numeric, log10(L_sun)) Upper (positive) 1-sigma uncertainty on st_lum.

luminosity_log_solar_lower_err (numeric, log10(L_sun)) Lower (negative) 1-sigma uncertainty on st_lum.

luminosity_log_solar_limit_flag (numeric) Limit flag for st_lum: 1 = upper limit, -1 = lower limit, 0 = a measured value.

log_g (numeric, log10(cm/s^2)) Gravitational acceleration at the stellar surface (log10).

log_g_upper_err (numeric, log10(cm/s^2)) Upper (positive) 1-sigma uncertainty on st_logg.

log_g_lower_err (numeric, log10(cm/s^2)) Lower (negative) 1-sigma uncertainty on st_logg.

log_g_limit_flag (numeric) Limit flag for st_logg: 1 = upper limit, -1 = lower limit, 0 = a measured value.

age_gyr (numeric, Gyr) Age of the host star in billions of years.

age_gyr_upper_err (numeric, Gyr) Upper (positive) 1-sigma uncertainty on st_age.

age_gyr_lower_err (numeric, Gyr) Lower (negative) 1-sigma uncertainty on st_age.

age_gyr_limit_flag (numeric) Limit flag for st_age: 1 = upper limit, -1 = lower limit, 0 = a measured value.

mass_solar (numeric, Solar masses) Stellar mass in units of the Sun's mass.

mass_solar_upper_err (numeric, Solar masses) Upper (positive) 1-sigma uncertainty on st_mass.

mass_solar_lower_err (numeric, Solar masses) Lower (negative) 1-sigma uncertainty on st_mass.

mass_solar_limit_flag (numeric) Limit flag for st_mass: 1 = upper limit, -1 = lower limit, 0 = a measured value.

density_g_cm3 (numeric, g/cm^3) Stellar mass per unit volume.

density_g_cm3_upper_err (numeric, g/cm^3) Upper (positive) 1-sigma uncertainty on st_dens.

density_g_cm3_lower_err (numeric, g/cm^3) Lower (negative) 1-sigma uncertainty on st_dens.

density_g_cm3_limit_flag (numeric) Limit flag for st_dens: 1 = upper limit, -1 = lower limit, 0 = a measured value.

radius_solar (numeric, Solar radii) Stellar radius in units of the Sun's radius.

radius_solar_upper_err (numeric, Solar radii) Upper (positive) 1-sigma uncertainty on st_rad.

radius_solar_lower_err (numeric, Solar radii) Lower (negative) 1-sigma uncertainty on st_rad.

radius_solar_limit_flag (numeric) Limit flag for st_rad: 1 = upper limit, -1 = lower limit, 0 = a measured value.

n_stars (numeric) Number of gravitationally bound stars in the planetary system.

n_planets (numeric) Number of confirmed planets in the planetary system.

n_moons (numeric) Number of confirmed moons in the planetary system.

proper_motion_total_mas_yr (numeric, mas/yr) Total angular change in position over time relative to Solar System barycenter.

proper_motion_total_mas_yr_upper_err (numeric, mas/yr) Upper (positive) 1-sigma uncertainty on sy_pm.

proper_motion_total_mas_yr_lower_err (numeric, mas/yr) Lower (negative) 1-sigma uncertainty on sy_pm.

proper_motion_ra_mas_yr (numeric, mas/yr) Proper motion in right ascension.

proper_motion_ra_mas_yr_upper_err (numeric, mas/yr) Upper (positive) 1-sigma uncertainty on sy_pmra.

proper_motion_ra_mas_yr_lower_err (numeric, mas/yr) Lower (negative) 1-sigma uncertainty on sy_pmra.

proper_motion_dec_mas_yr (numeric, mas/yr) Proper motion in declination.

proper_motion_dec_mas_yr_upper_err (numeric, mas/yr) Upper (positive) 1-sigma uncertainty on sy_pmdec.

proper_motion_dec_mas_yr_lower_err (numeric, mas/yr) Lower (negative) 1-sigma uncertainty on sy_pmdec.

parallax_mas (numeric, mas) Annual parallax of the system.

parallax_mas_upper_err (numeric, mas) Upper (positive) 1-sigma uncertainty on sy_plx.

parallax_mas_lower_err (numeric, mas) Lower (negative) 1-sigma uncertainty on sy_plx.

distance_pc (numeric, pc) Distance to the planetary system in parsecs.

distance_pc_upper_err (numeric, pc) Upper (positive) 1-sigma uncertainty on sy_dist.

distance_pc_lower_err (numeric, pc) Lower (negative) 1-sigma uncertainty on sy_dist.

mag_b_johnson (numeric, mag) Apparent brightness in the B (Johnson) photometric band.

mag_b_johnson_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_bmag.

mag_b_johnson_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_bmag.

mag_v_johnson (numeric, mag) Apparent brightness in the V (Johnson) photometric band.

mag_v_johnson_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_vmag.

mag_v_johnson_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_vmag.

mag_j_2mass (numeric, mag) Apparent brightness in the 2MASS J band.

mag_j_2mass_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_jmag.

mag_j_2mass_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_jmag.

mag_h_2mass (numeric, mag) Apparent brightness in the 2MASS H band.

mag_h_2mass_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_hmag.

mag_h_2mass_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_hmag.

mag_k_2mass (numeric, mag) Apparent brightness in the 2MASS Ks band.

mag_k_2mass_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_kmag.

mag_k_2mass_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_kmag.

mag_u_sloan (numeric, mag) Apparent brightness in the SDSS u band.

mag_u_sloan_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_umag.

mag_u_sloan_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_umag.

mag_r_sloan (numeric, mag) Apparent brightness in the SDSS r band.

mag_r_sloan_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_rmag.

mag_r_sloan_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_rmag.

mag_i_sloan (numeric, mag) Apparent brightness in the SDSS i band.

mag_i_sloan_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_imag.

mag_i_sloan_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_imag.

mag_z_sloan (numeric, mag) Apparent brightness in the SDSS z band.

mag_z_sloan_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_zmag.

mag_z_sloan_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_zmag.

mag_w1_wise (numeric, mag) Apparent brightness in the WISE 3.4 micron band.

mag_w1_wise_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_w1mag.

mag_w1_wise_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_w1mag.

mag_w2_wise (numeric, mag) Apparent brightness in the WISE 4.6 micron band.

mag_w2_wise_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_w2mag.

mag_w2_wise_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_w2mag.

mag_w3_wise (numeric, mag) Apparent brightness in the WISE 12 micron band.

mag_w3_wise_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_w3mag.

mag_w3_wise_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_w3mag.

mag_w4_wise (numeric, mag) Apparent brightness in the WISE 22 micron band.

mag_w4_wise_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_w4mag.

mag_w4_wise_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_w4mag.

mag_g_sloan (numeric, mag) Apparent brightness in the SDSS g band.

mag_g_sloan_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_gmag.

mag_g_sloan_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_gmag.

mag_gaia (numeric, mag) Apparent brightness in the Gaia G band.

mag_gaia_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_gaiamag.

mag_gaia_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_gaiamag.

mag_tess (numeric, mag) Apparent brightness in the TESS bandpass.

mag_tess_upper_err (numeric, mag) Upper (positive) 1-sigma uncertainty on sy_tmag.

mag_tess_lower_err (numeric, mag) Lower (negative) 1-sigma uncertainty on sy_tmag.

system_name (character) Name of the system the star belongs to.

metallicity_ratio (character) Ratio used to express metallicity (e.g. [Fe/H], [M/H]).

spectral_type (character) Morgan-Keenan spectral classification of the star.

mag_kepler (numeric, mag) Apparent brightness in the Kepler bandpass.

mag_kepler_upper_err (logical, mag) Upper (positive) 1-sigma uncertainty on sy_kepmag.

mag_kepler_lower_err (logical, mag) Lower (negative) 1-sigma uncertainty on sy_kepmag.

rotation_period_days (numeric, days) Time required for one full rotation (assuming solid-body rotation).

rotation_period_days_upper_err (numeric, days) Upper (positive) 1-sigma uncertainty on st_rotp.

rotation_period_days_lower_err (numeric, days) Lower (negative) 1-sigma uncertainty on st_rotp.

rotation_period_days_limit_flag (numeric) Limit flag for st_rotp: 1 = upper limit, -1 = lower limit, 0 = a measured value.

gaia_dr2_id (character) Gaia Data Release 2 identifier.

gaia_dr3_id (character) Gaia Data Release 3 identifier.

circumbinary_flag (numeric) 1 if planet orbits a binary system, 0 otherwise.

Details

Many columns follow a base + suffix convention:

- `<col>_upper_err`: upper (+) 1-sigma uncertainty on `<col>`
- `<col>_lower_err`: lower (-) 1-sigma uncertainty on `<col>`
- `<col>_limit_flag`: limit flag (1 = upper limit, -1 = lower limit, 0 = measured)

Source

NASA Exoplanet Archive Stellar Hosts columns documentation: https://exoplanetarchive.ipac.caltech.edu/docs/API_STELLARHOSTS_columns.html. Retrieved via the **REXoplanets** package.

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