SWEET-cat

A Portal for Homogeneous Planet Host Characterization

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Abstract:

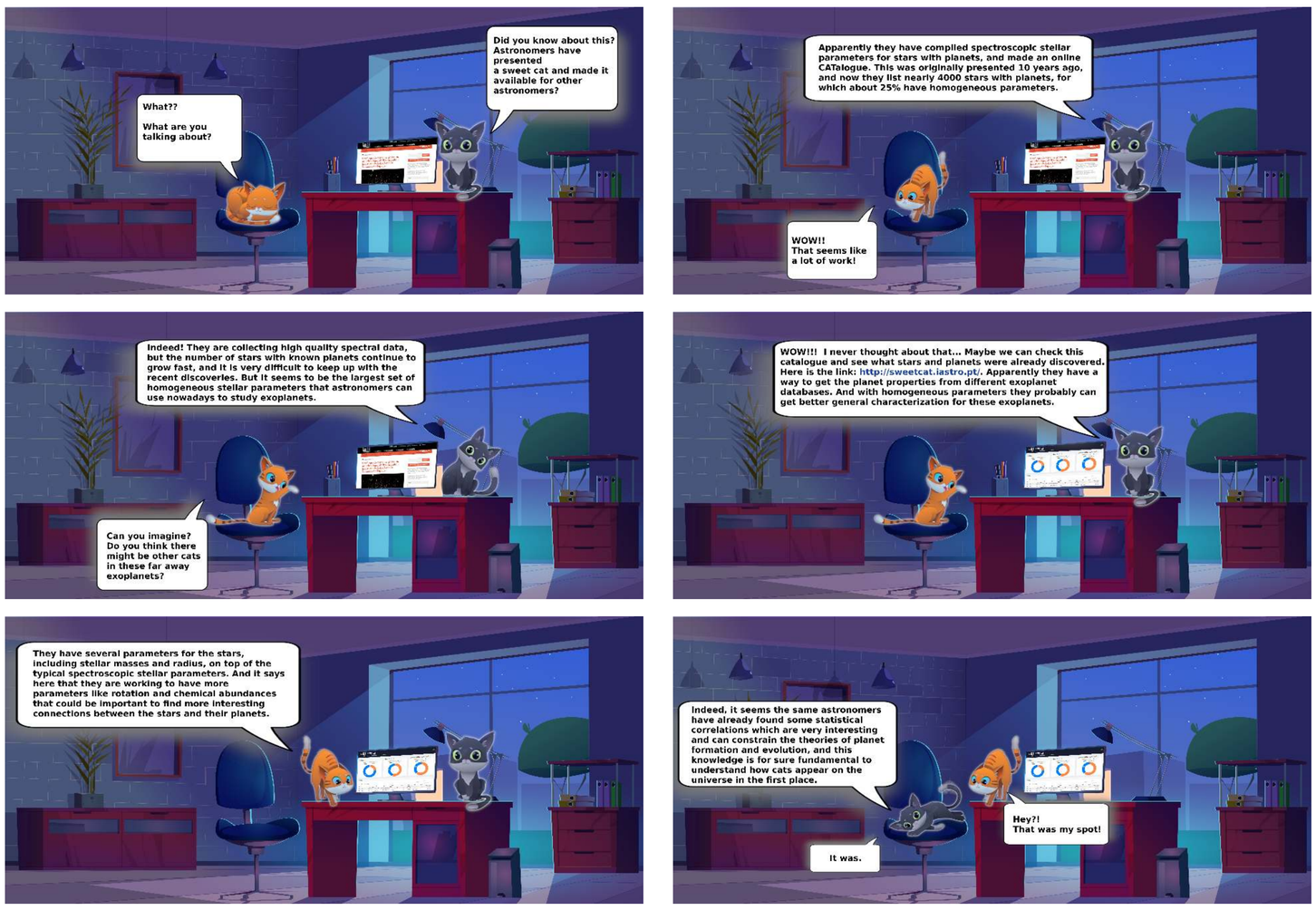
SWEET-Cat (Stars With ExoplanETs Catalogue) provides precise and homogeneous stellar parameters for planet-host stars, enabling robust statistical studies of exoplanetary systems. Here we present a significant update to the catalogue, increasing the number of stars with homogeneous spectroscopic parameters to over 1100.

Using this improved dataset, we revisit the planetary mass–radius relation by combining SWEET-Cat stellar properties with up-to-date exoplanet parameters.

The results clearly reveal two distinct regimes: a rising trend of radius with mass for low-mass planets, and a nearly flat relation for giant planets, with a transition occurring at approximately 150 Earth masses. This is consistent with previous studies but we benefit from reduced scatter and improved parameter precision enabled by homogeneous stellar characterization.

For giant planets, we explore the dependence of planetary radii on equilibrium temperature, confirming a strong positive correlation. After accounting for this effect, we revisit the radius anomaly and find a significant correlation with host star metallicity, supporting the idea that stellar composition plays a key role in shaping planetary structure.

This work highlights the importance of homogeneous stellar parameters for uncovering and refining key trends in exoplanet populations, demonstrating that improved stellar characterization directly translates into clearer insights into planet formation and evolution.



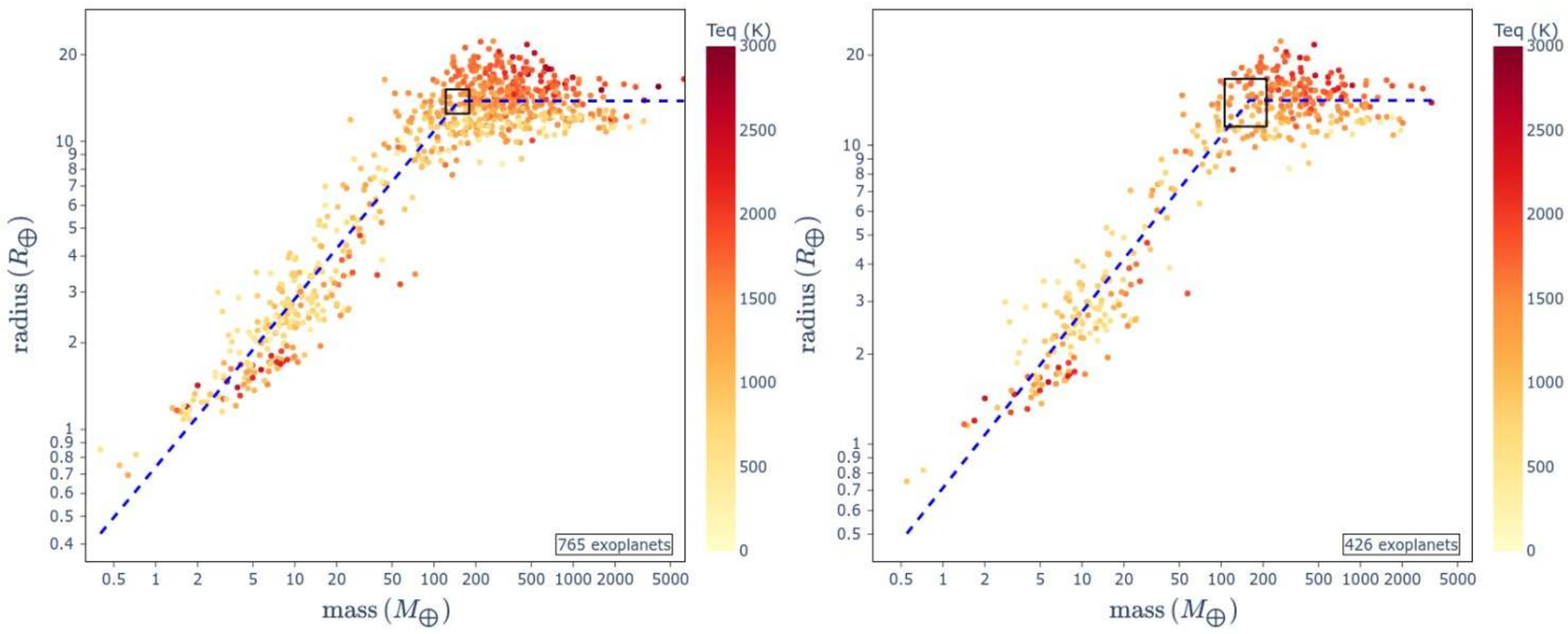


Figure 1: The planetary mass - radius relation for planets orbiting stars listed in SWEET-Cat catalog. The left panel includes all the planets with precise values for planetary mass and radius, while in the right panel, are only the planets hosted by stars with homogeneous stellar parameters. The black box represents the position and its respective uncertainty for the transition between the two regimes.

Table: Parameters of the multi fit - m1 and b1 are the slope and intercept of the linear model for the low-mass planets. m2 and b2 is the slope and intercept of the linear model for the high-mass planets. xc and yc are the interception mass, and radius, point of the two linear models.

Parameter	Full set (765)	Homogeneous (426)
m_1	0.58 ± 0.01	0.59 ± 0.01
b_1	-0.13 ± 0.01	-0.15 ± 0.02
m_2	0.00 ± 0.01	0.00 ± 0.02
b_2	1.14 ± 0.04	1.15 ± 0.06
x_c $[M_J]$	2.18 ± 0.08	2.20 ± 0.15
x_c $[M_\oplus]$	150 ± 29	159 ± 53
y_c $[R_\oplus]$	13.8 ± 1.3	14.1 ± 2.6

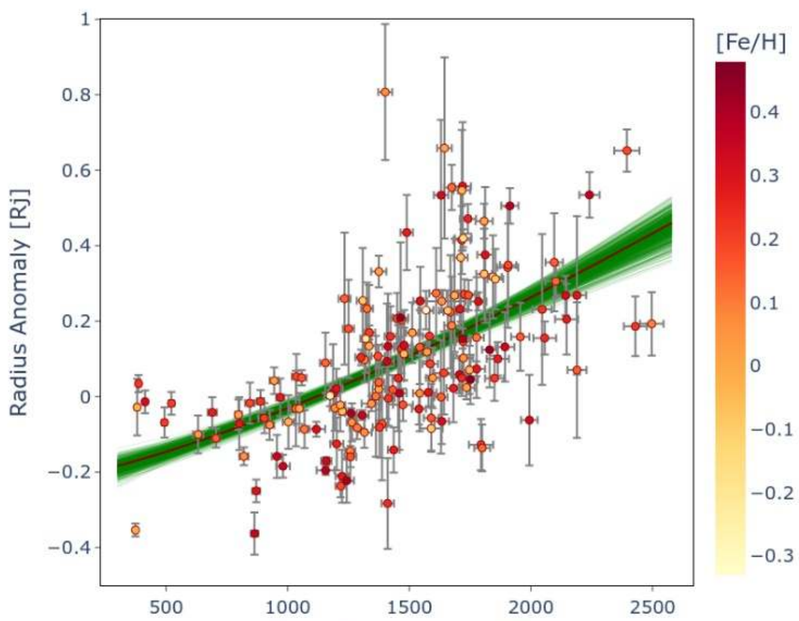


Figure 2: The radius anomaly vs. the equilibrium temperature for the The planet radius and equilibrium temperature for the 159 massive exoplanets (0.5MJ < mass < 10MJ) with homogeneous high precision [Fe/H]. The line is the best fit of a power law. The line is the best fit of a power law.

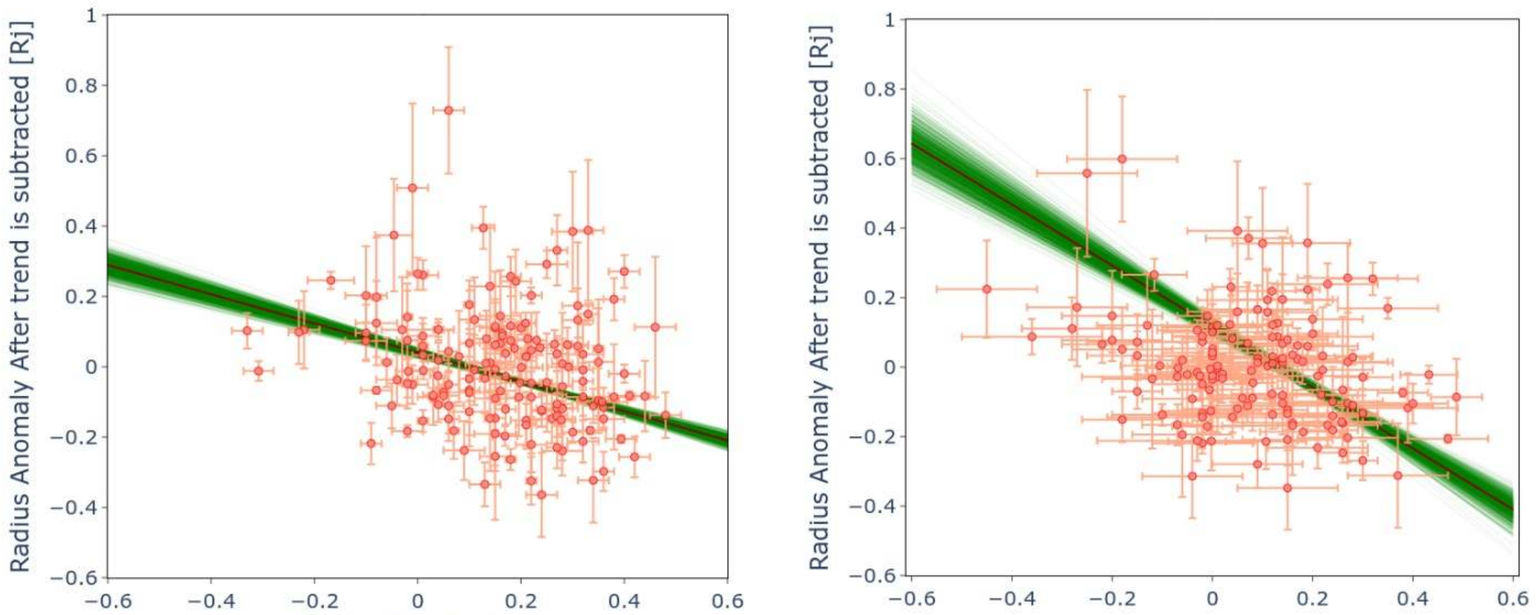


Figure 3: Left Panel: Radius anomaly with equilibrium temperature trend corrected versus the metallicity of the host star [Fe/H]. **Right Panel:** Same as left panel but using parameters directly listed in the NASA exoplanet archive.

Key Results:

- Two distinct mass–radius regimes identified, with a transition at ~150 M⊕;
- Giant planet radii strongly correlate with equilibrium temperature;
- Radius anomaly shows a clear dependence on host star metallicity;
- Homogeneous stellar parameters reduce scatter and strengthen observed trends;

Check our last paper:

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