

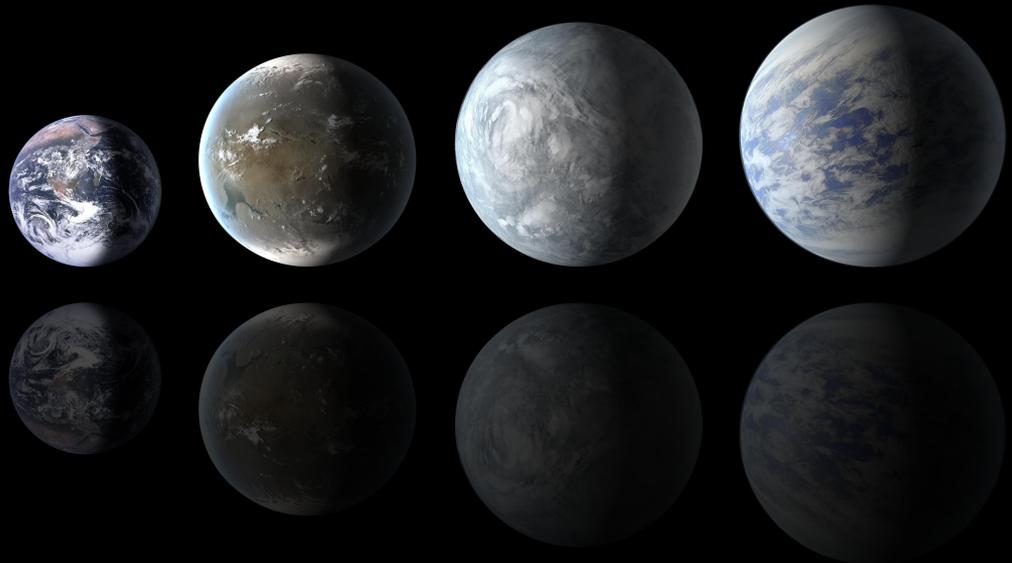


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Two terrestrial families with different origin

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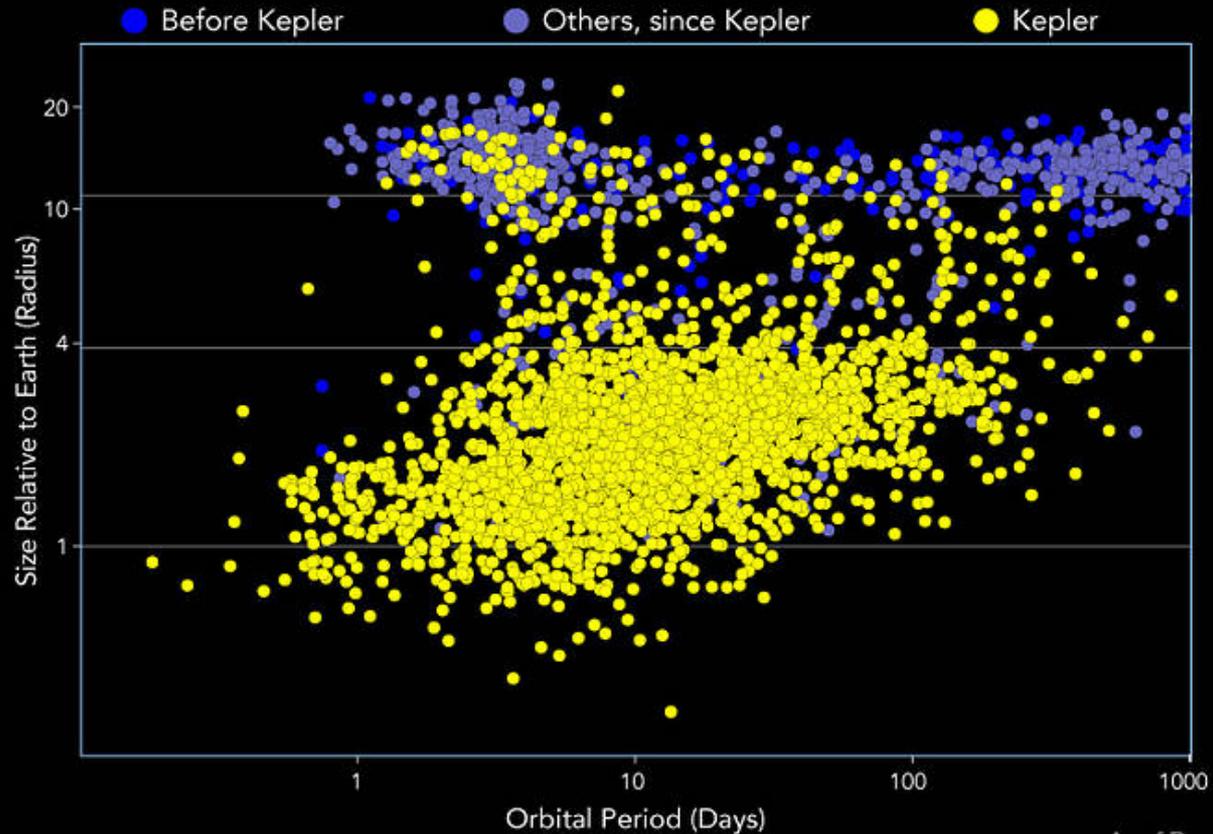
with Mark Swain, Christophe Sotin, Gael
Rodier and Robert Zellem



Exoplanet Discoveries

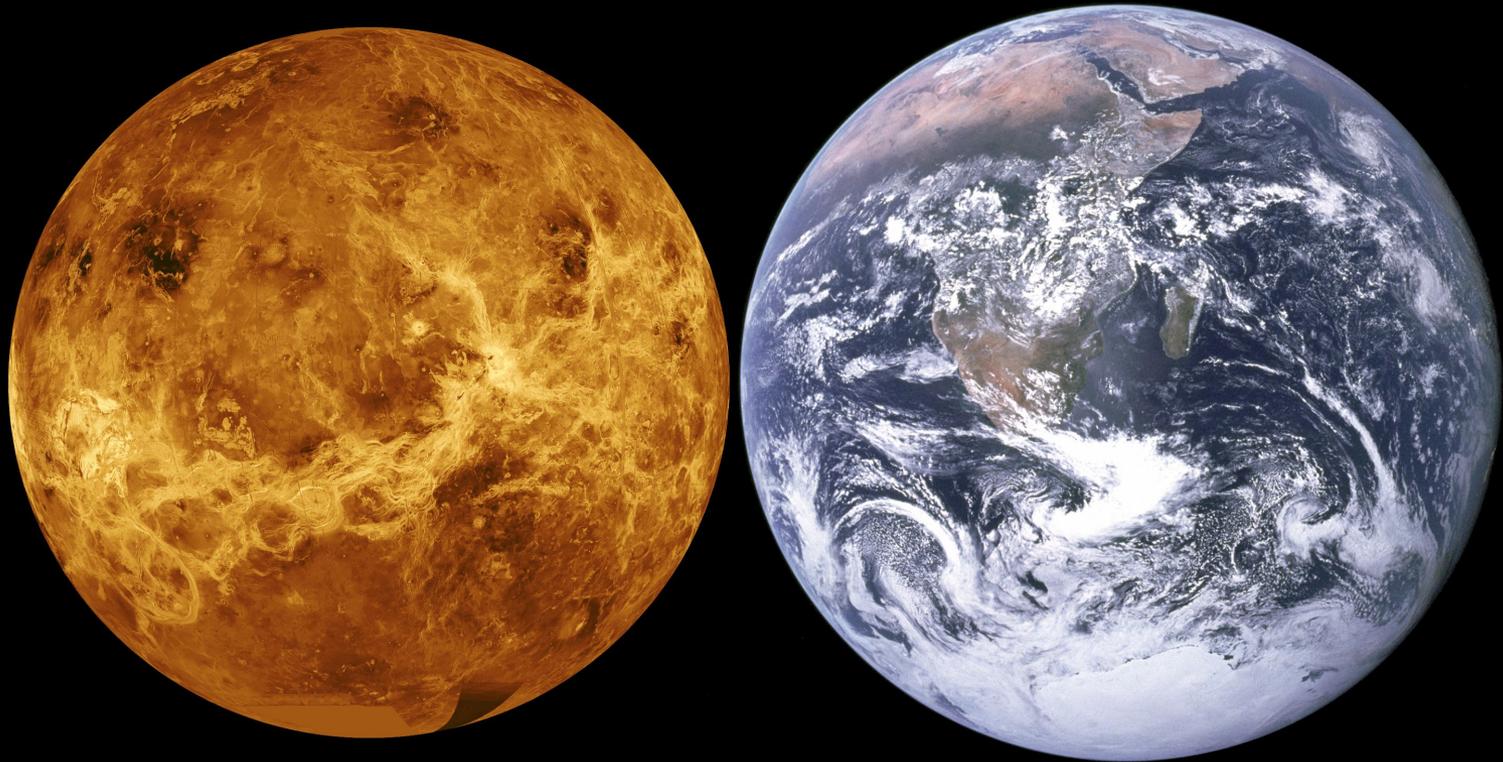
Total confirmed exoplanets = 3,567

Total Kepler = 2,525



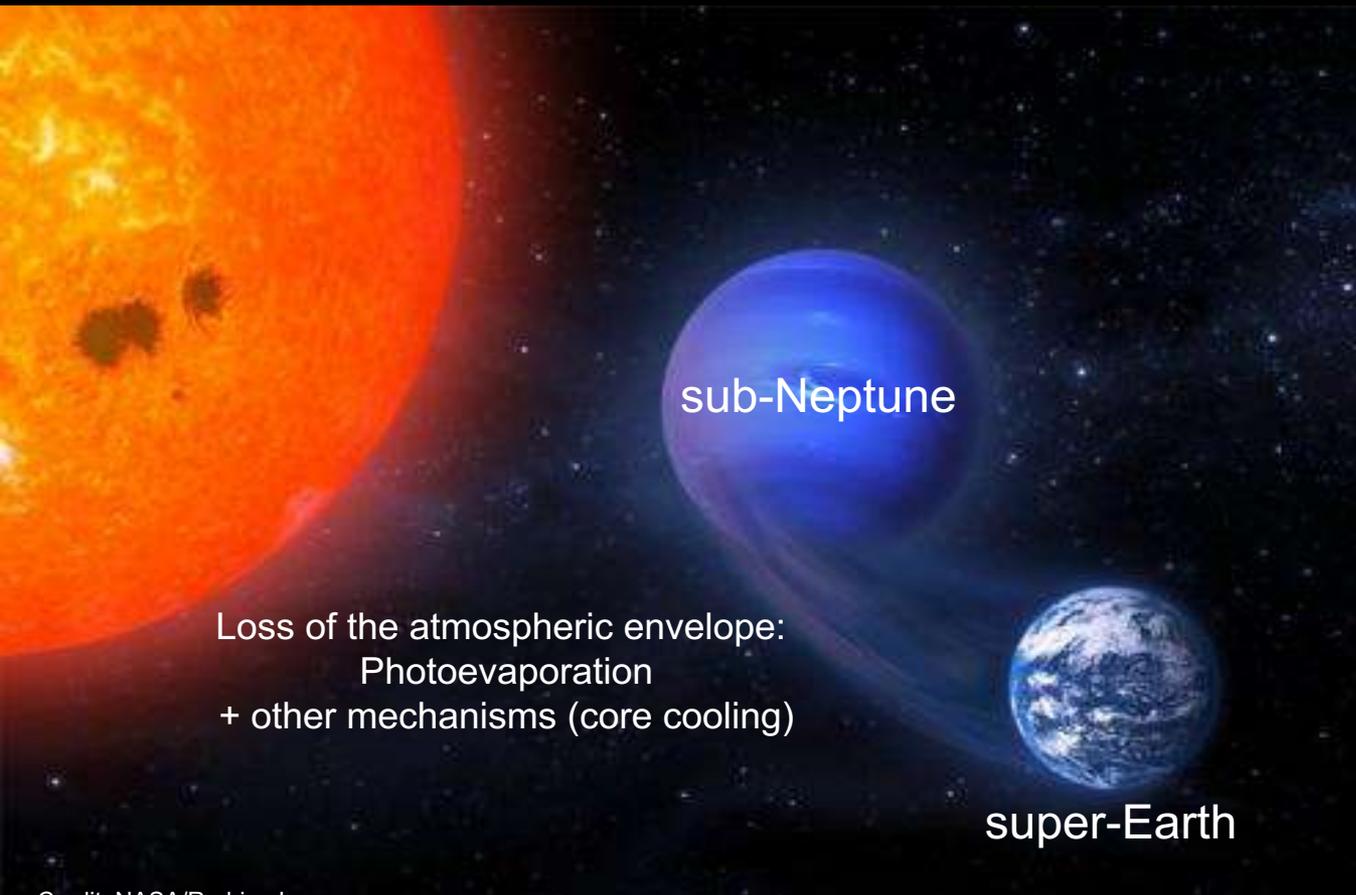
Credit: NASA

Terrestrials exoplanets: Are they Earth/Venus-like?



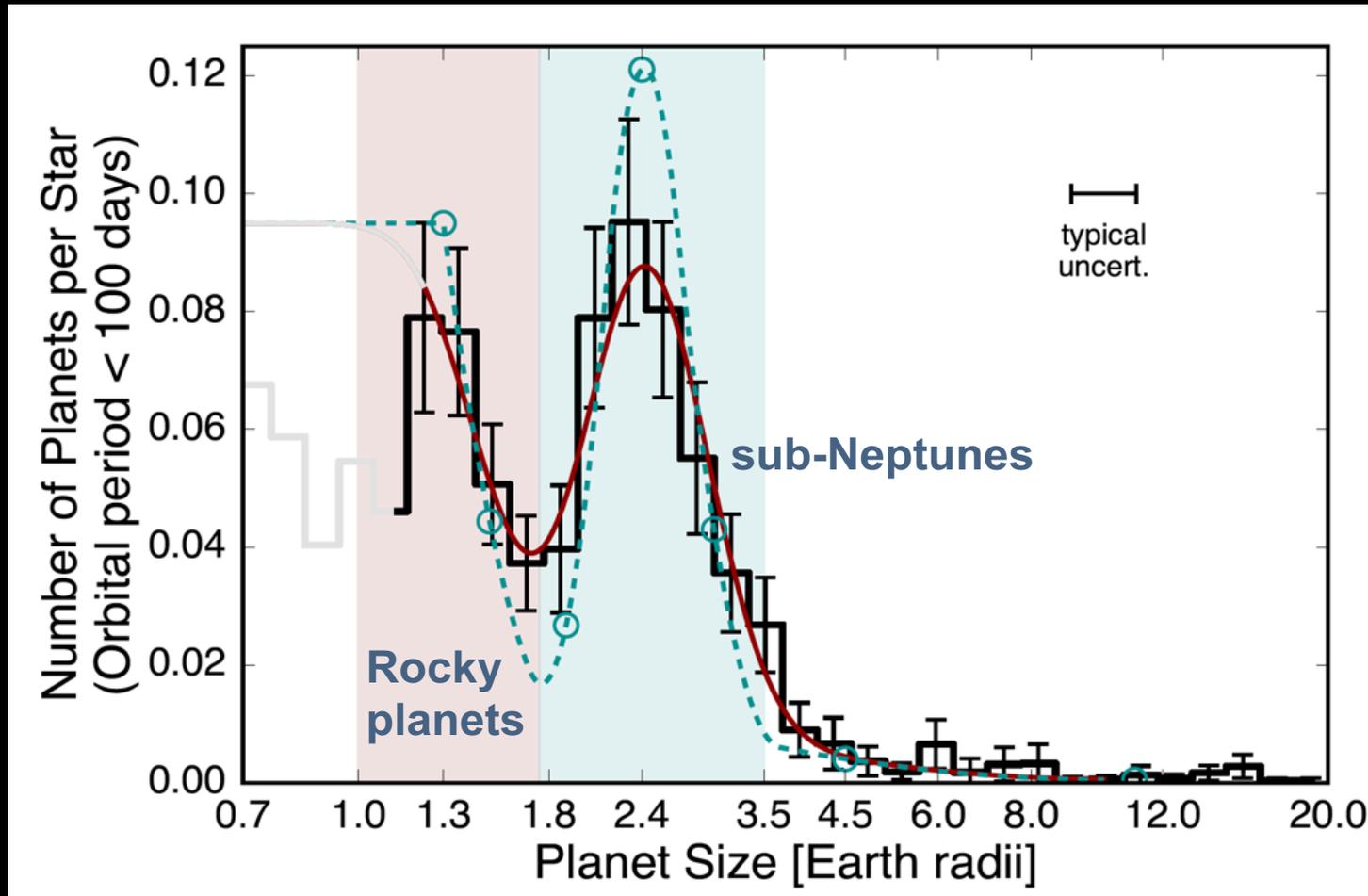
Credit: NASA/JPL

Terrestrials exoplanets: ...or are they remnants of the core of sub-Neptunes?



Credit: NASA/Rodrigo Luger

Evidence for sub-Neptunes transition: Radius gap



Fulton et al. (2017)

- **Our goal:**

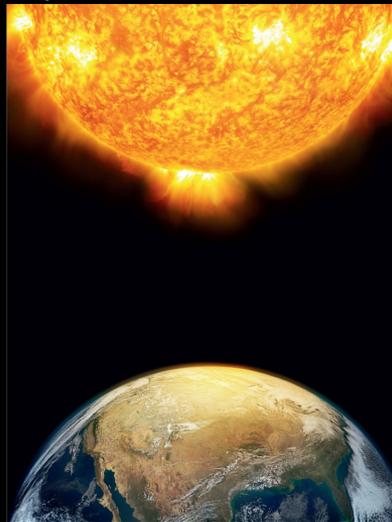
Understand the processes that shape the bulk properties of small planets by exploring the relationships between:

Image Credit: NASA/JPL-Caltech



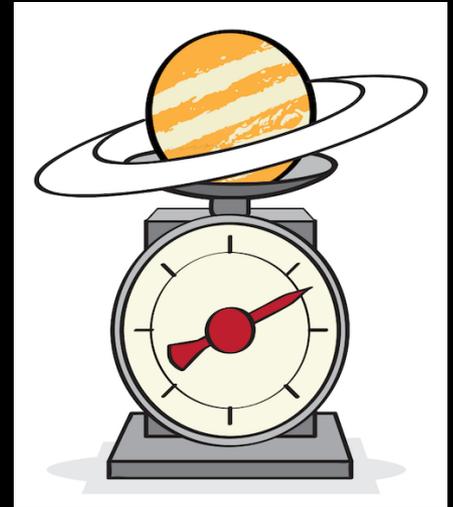
Radius

Image Credit: Shutterstock



Insolation

Image Credit: NASA



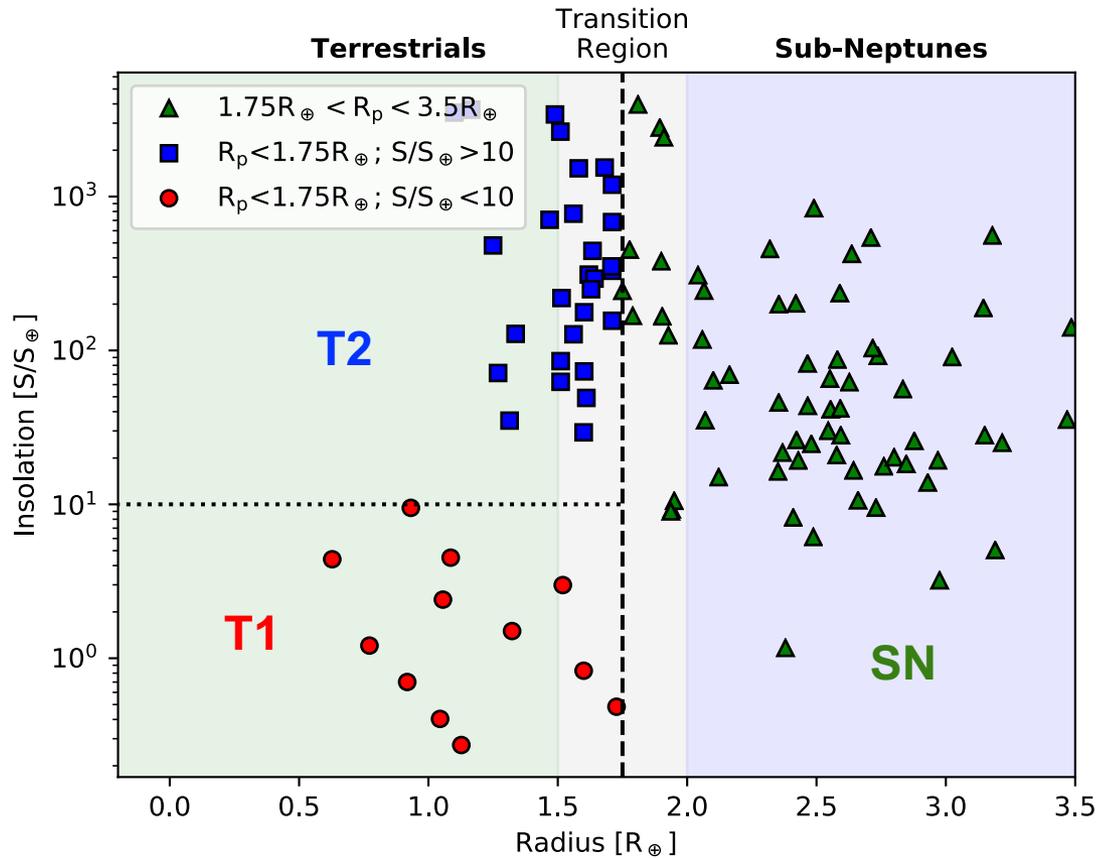
Density

- Our sample:

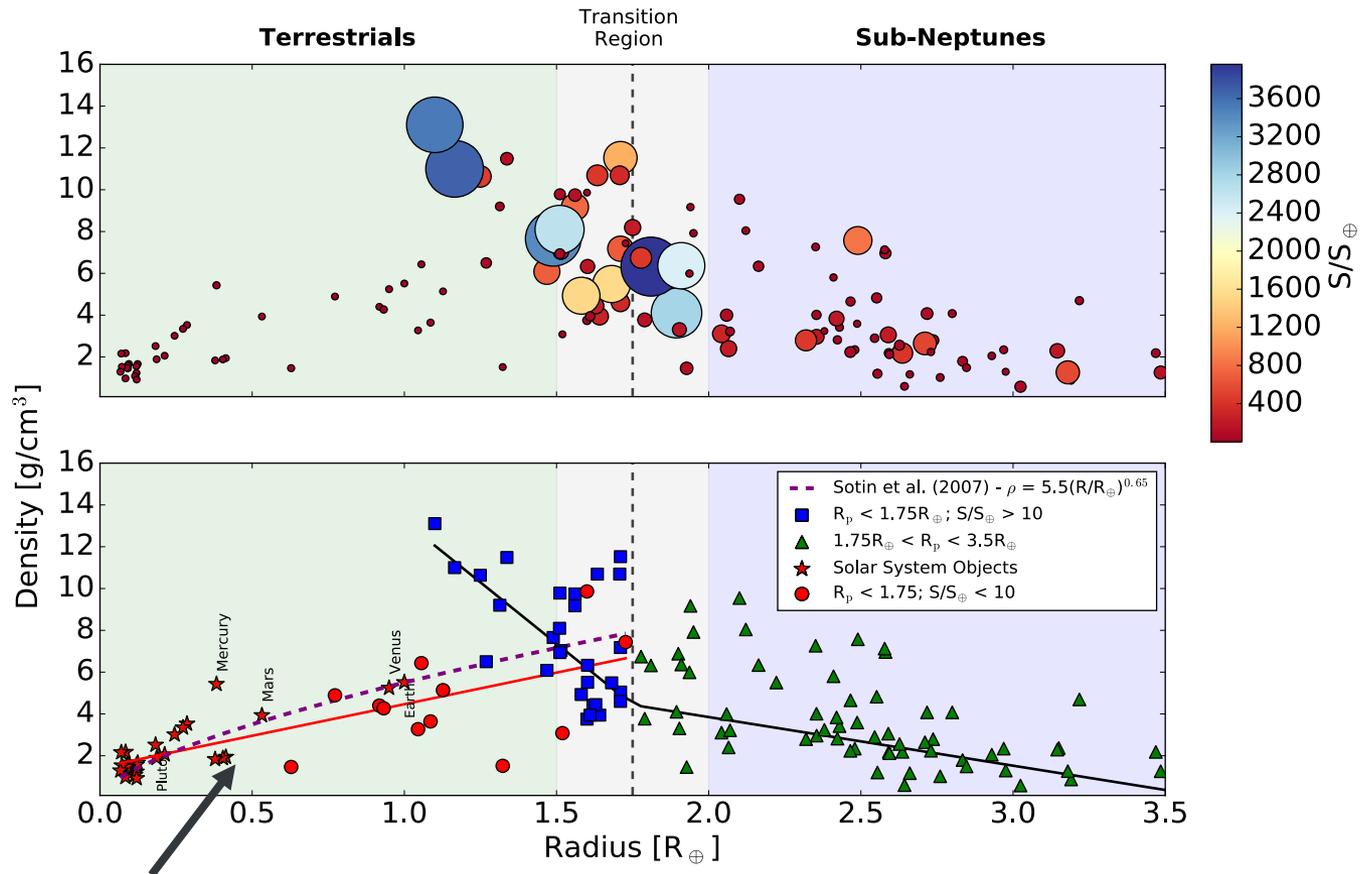
1. We used data from the NASA Exoplanet Archive and Marcy et al. (2014), and restricted the sample to confirmed planets with radius values $\leq 3.5 R_{\oplus}$
2. Kepler target radii were updated with GAIA-derived values and the densities for the planets were recalculated.
3. We assembled a list of 28 solar system bodies with reported densities and radii between $400 \text{ km} < R < R_{\oplus}$.

1) Insolation-radius plane

Terrestrial planets separate into two families

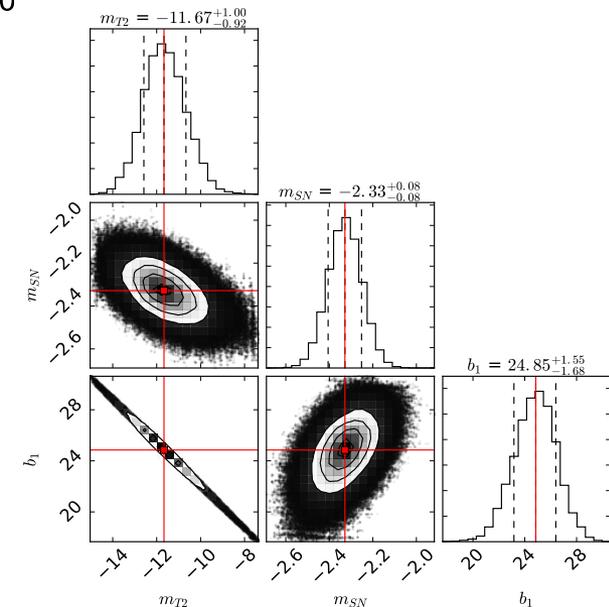
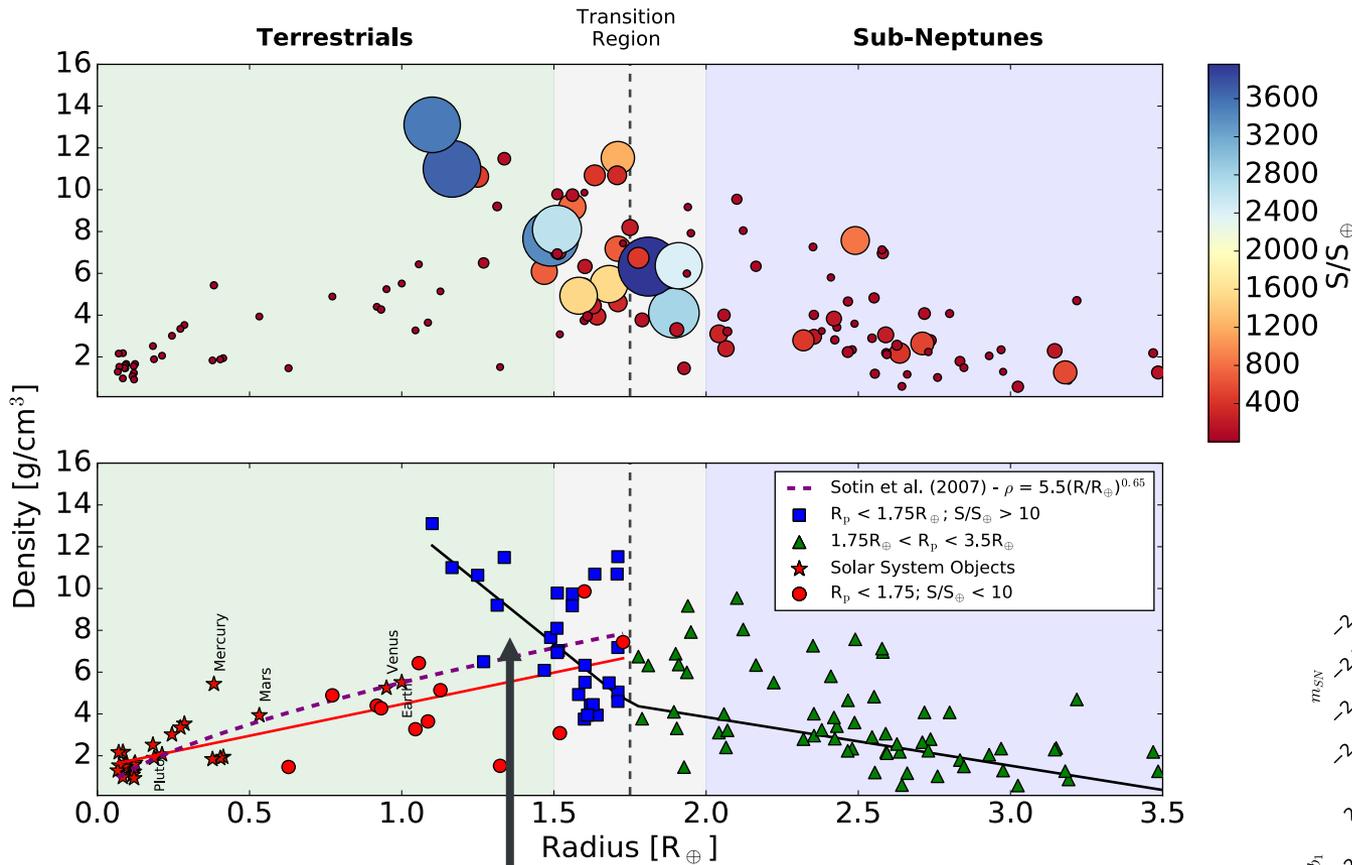


2) Density-radius plane



T1 Terrestrials: Possibly sharing a common formation mechanism with the solar system objects.

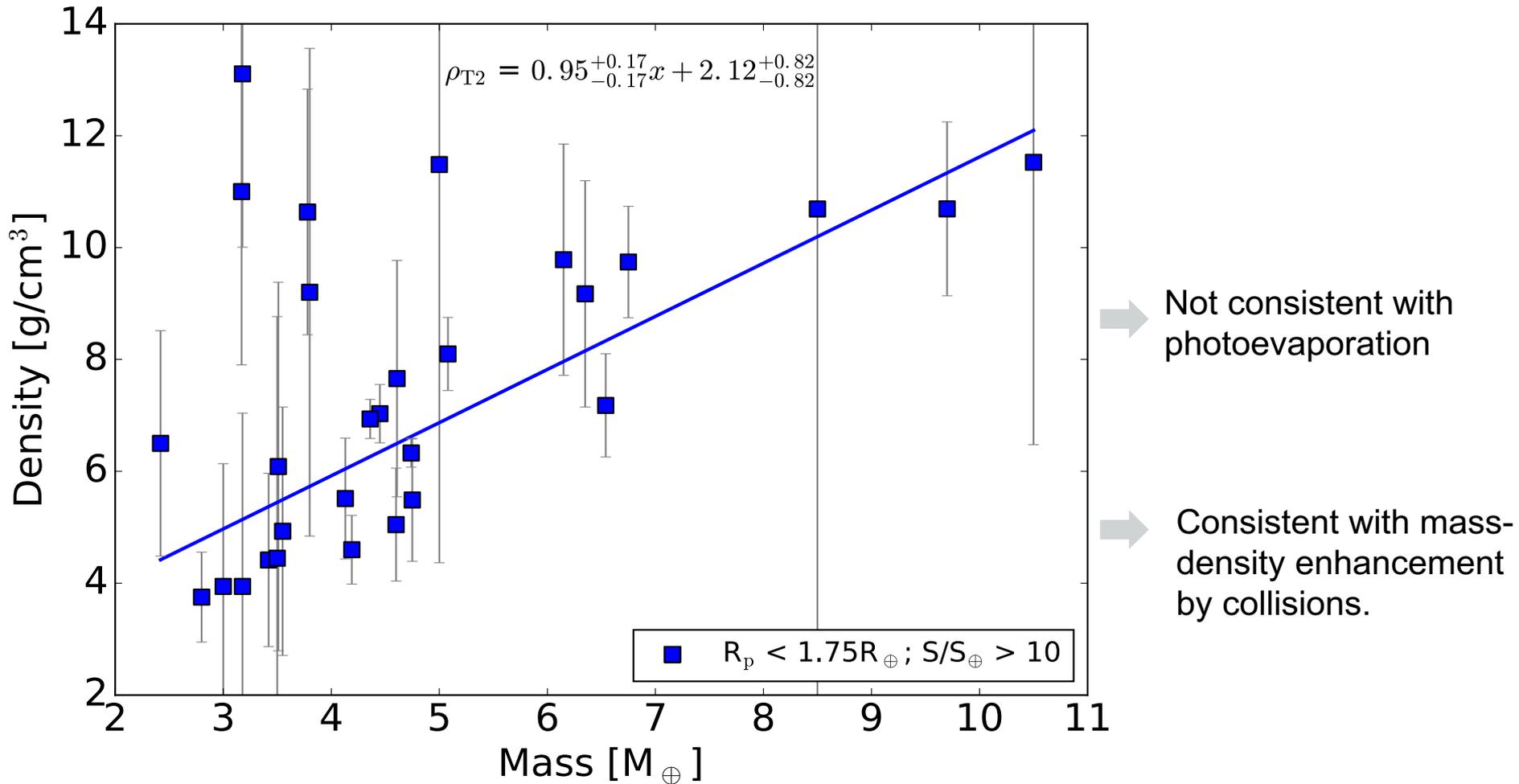
2) Density-radius plane



T2 Terrestrials:

- Form a continuous trend with the SN
- We modelled the T2 and SN with a bilinear piecewise continuous function and retrieved the posterior using **MCMC**

3) Density enhancement in the T2: mantle stripping (photoevaporation) or collisions?



Conclusions

Terrestrial planets naturally divide themselves into two families:

- The T1 family has low level of insolation and seems to be formed by collisions, like Earth and the solar system bodies.
- The T2 family has high levels of insolation and their density-radius trend implies they are the remnant cores of small gas giant planets.
- In both the T1 and T2 terrestrials collisions likely play an important role of density enhancement.

For more details: [arxiv:1811.07919](https://arxiv.org/abs/1811.07919)