Quick notes on

Planetary Mass-Radius

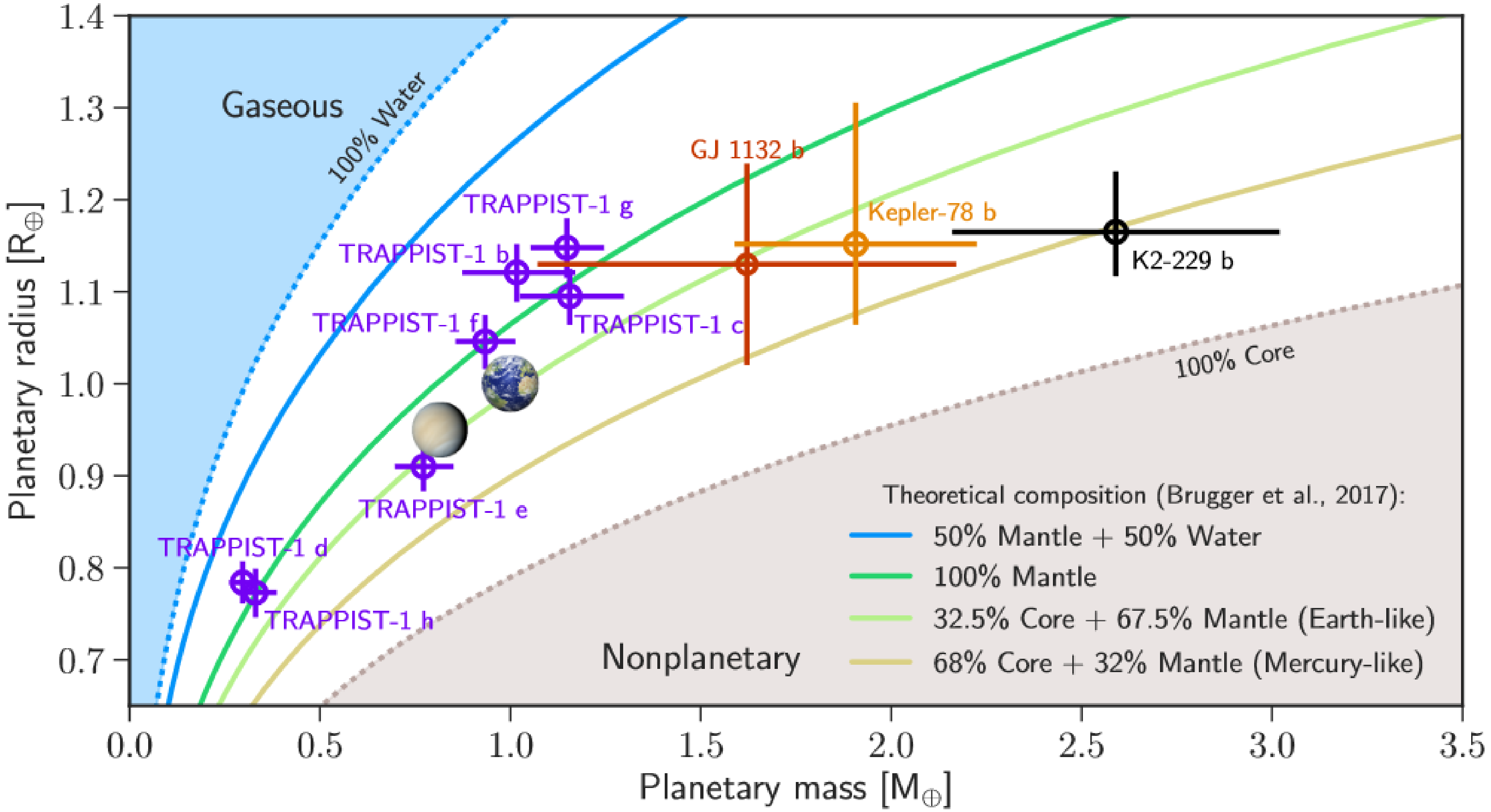
Zach Meisel

Ohio University - ASTR4201 - Fall 2020

For low-mass planets, $R \sim \sqrt{M}$

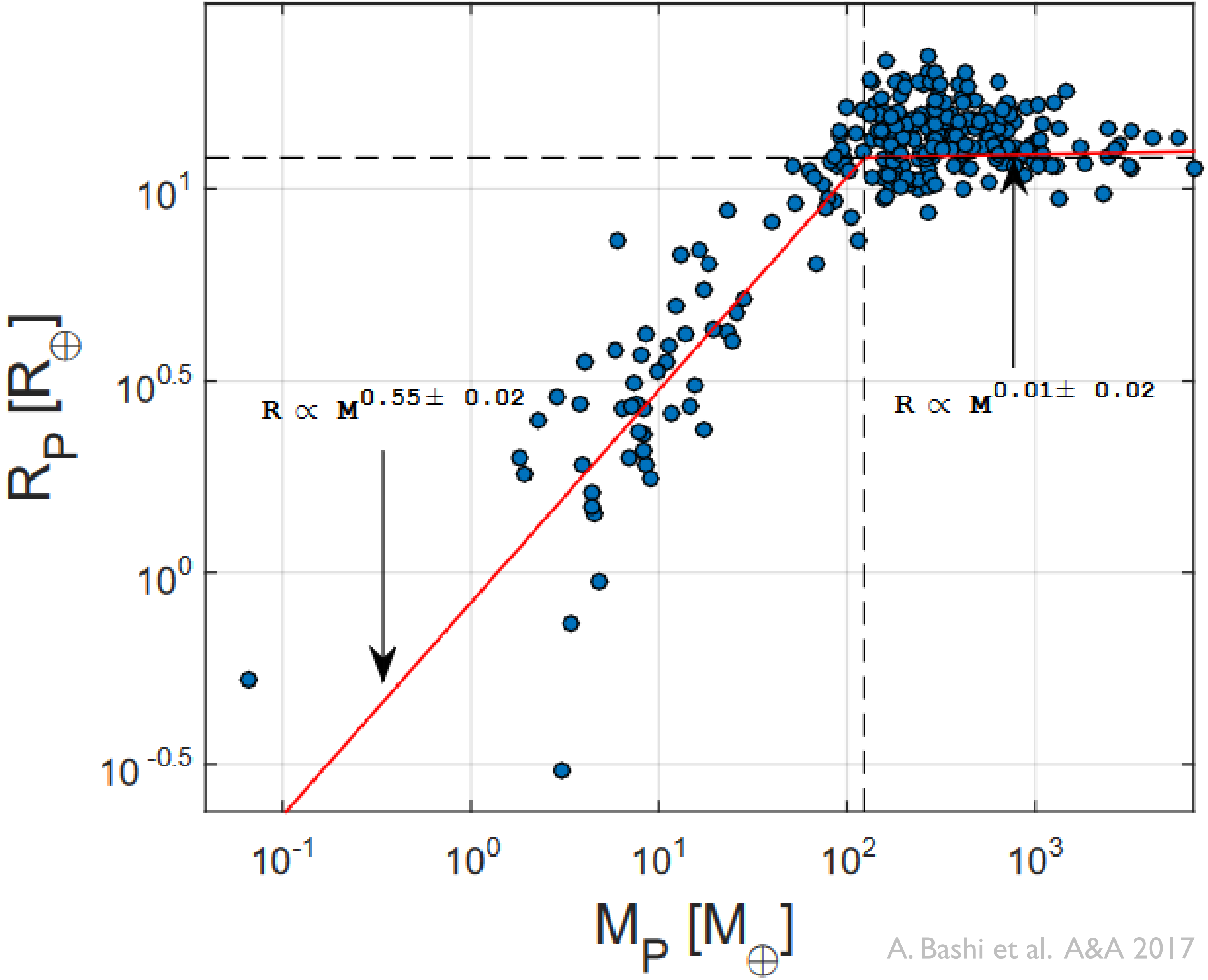
- In TBS exercise 6.8, we assume the density is set by atomic spacing, which we approximate using the Bohr radius
- We then set the electron degeneracy pressure equal to the central pressure from virial theorem (TBS 6.6)
- We find a parabolic relation, which holds-up pretty well against the data
- By being more sophisticated and specifying which type of matter we have, composition can be inferred

A. Santerne et al. Nature Astron. 2018



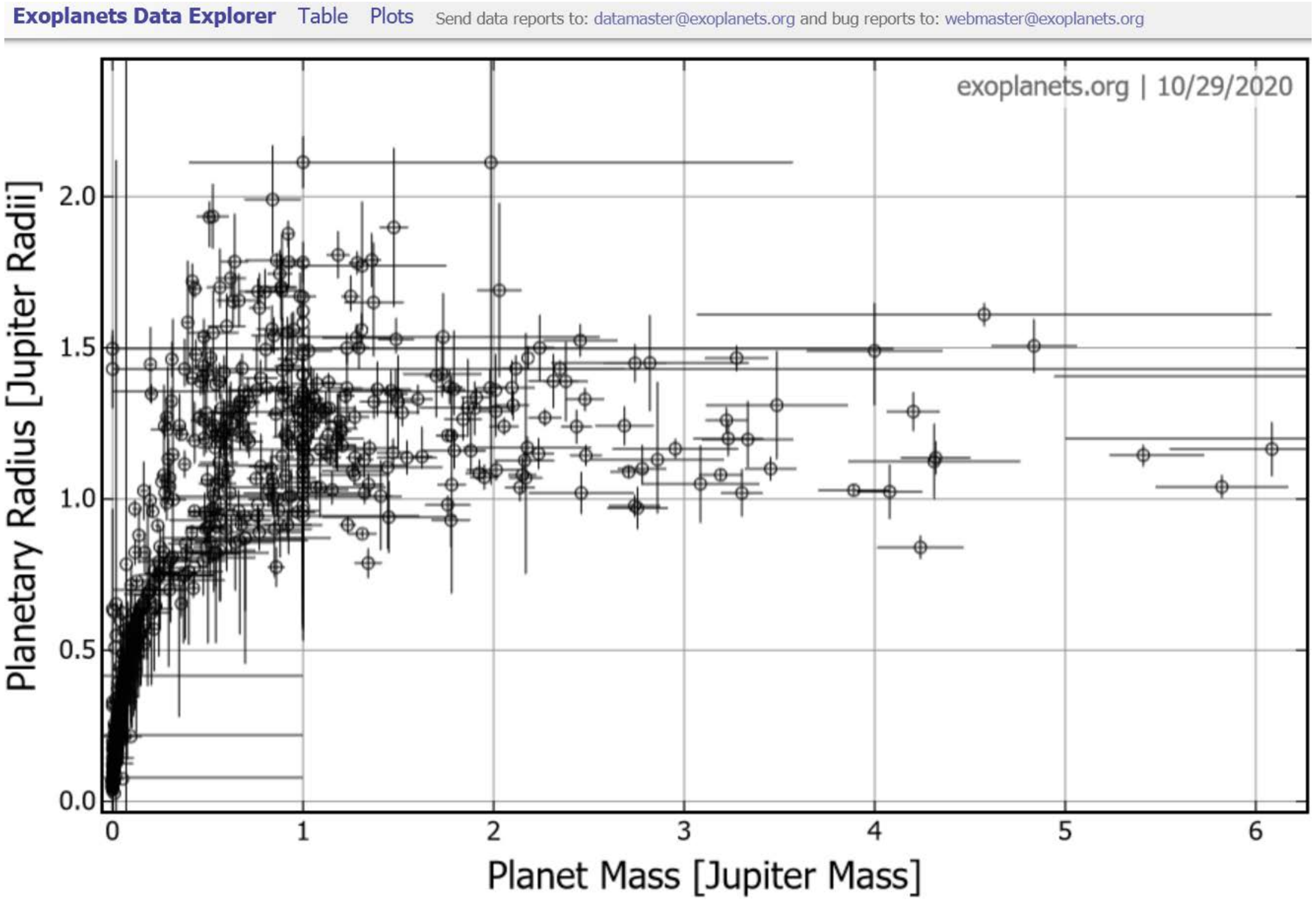
At some point, electron degeneracy pressure takes over

- Eventually, electron degeneracy pressure is a more significant factor than the Coulomb repulsion
- At this point, radius will actually decrease with mass.
  In TBS 6.6, we find $R \sim M^{-1/3}$ for an object like a white dwarf
- Far before we reach that point, the radius is roughly unchanged with increasing mass



A. Bashi et al. A&A 2017

Additional exoplanet data continues to inform our understanding



S. Seager et al. ApJ 2007