

Planet Size and Mass: Distinguishing Rocky Worlds



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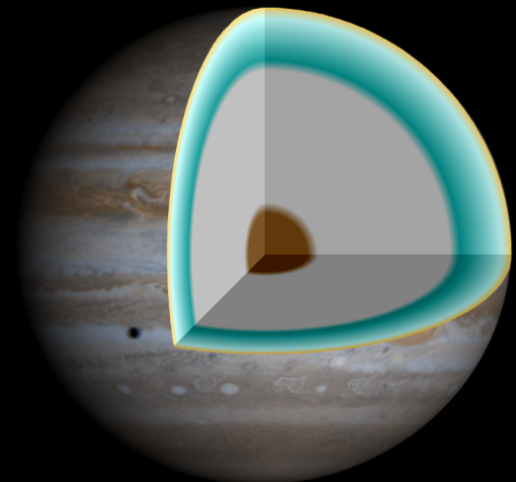
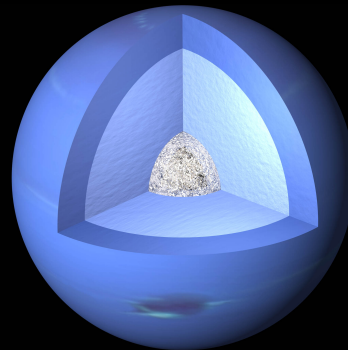
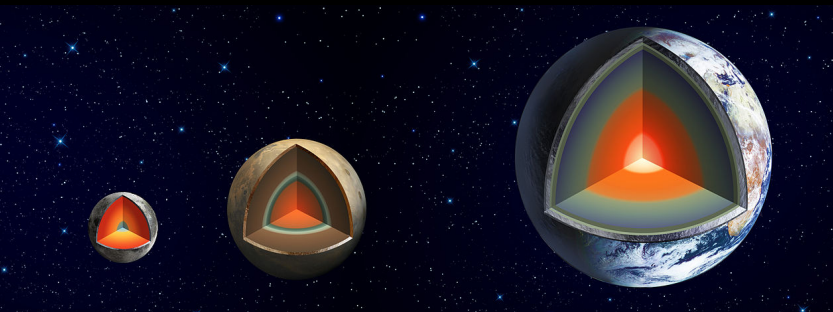
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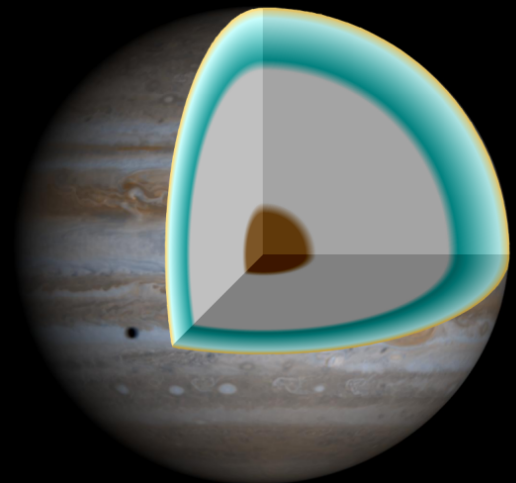
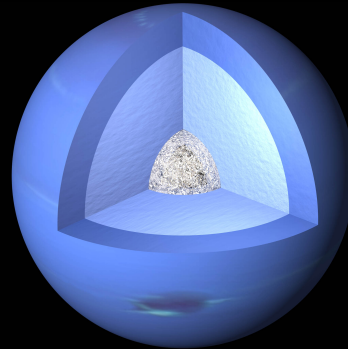
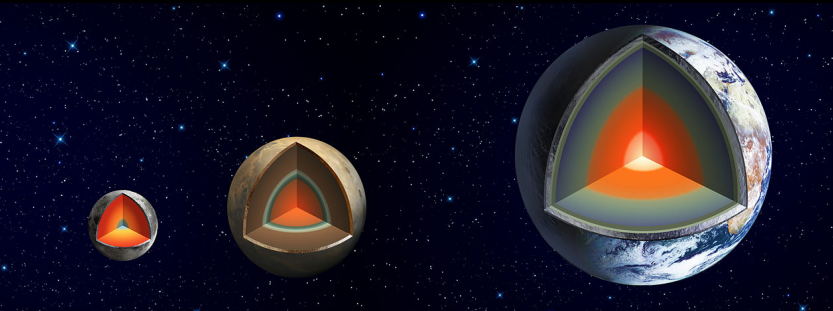
Do We Need to Measure Mass and Radius?

YES *

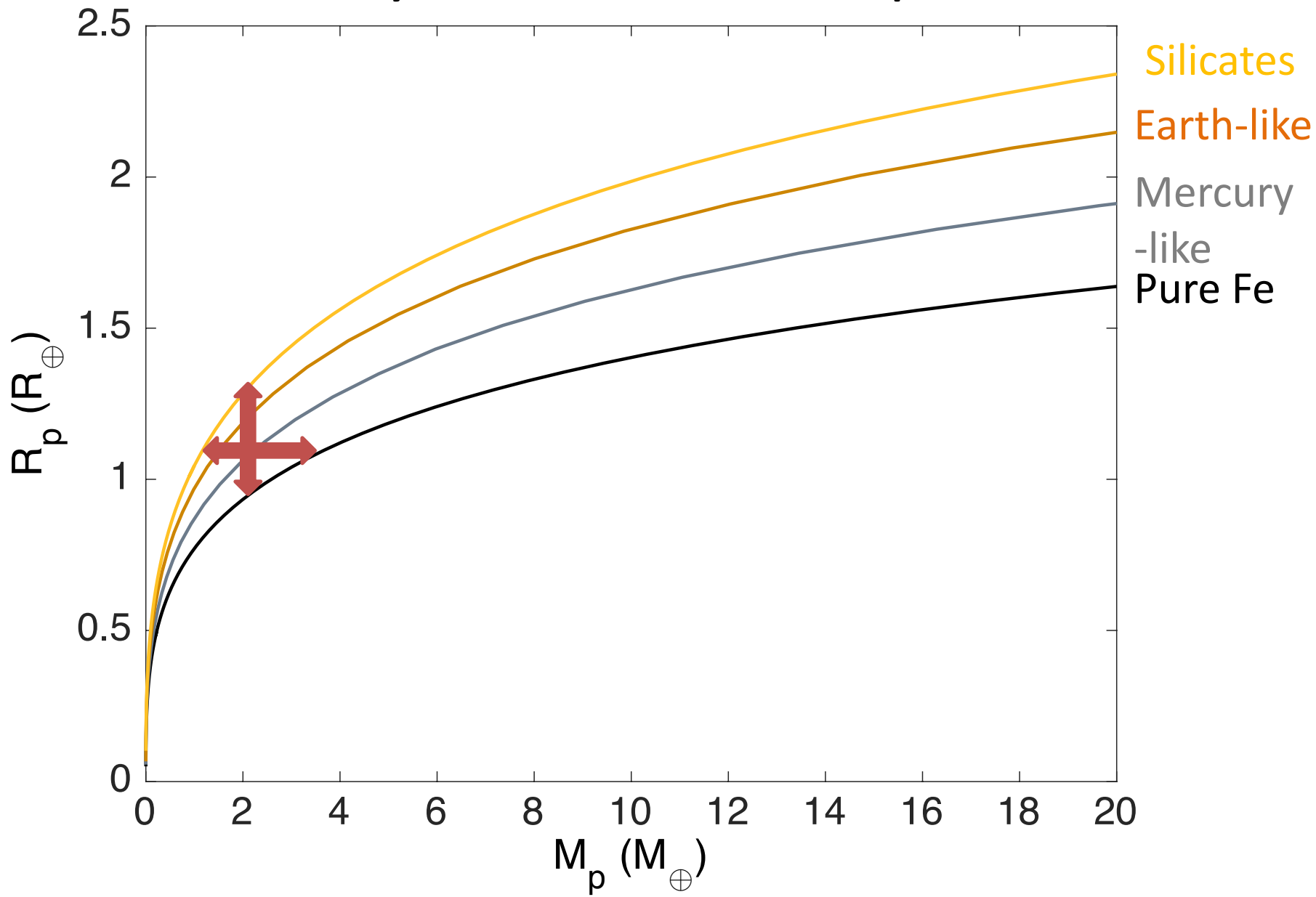
*Especially, if we proceed with Maggie's
exploration story line



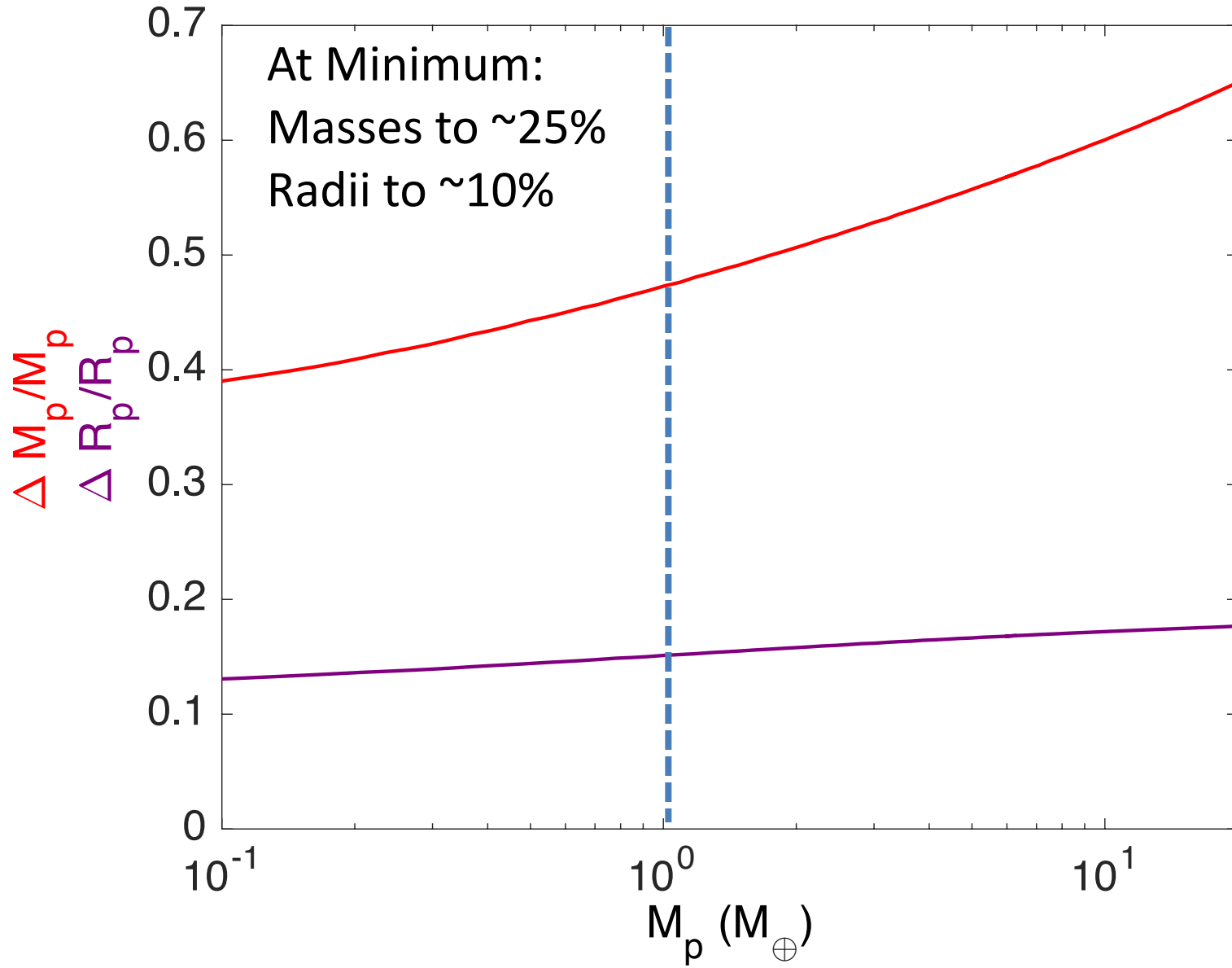
How precisely ~~Do~~ We Need to Measure Mass and Radius?



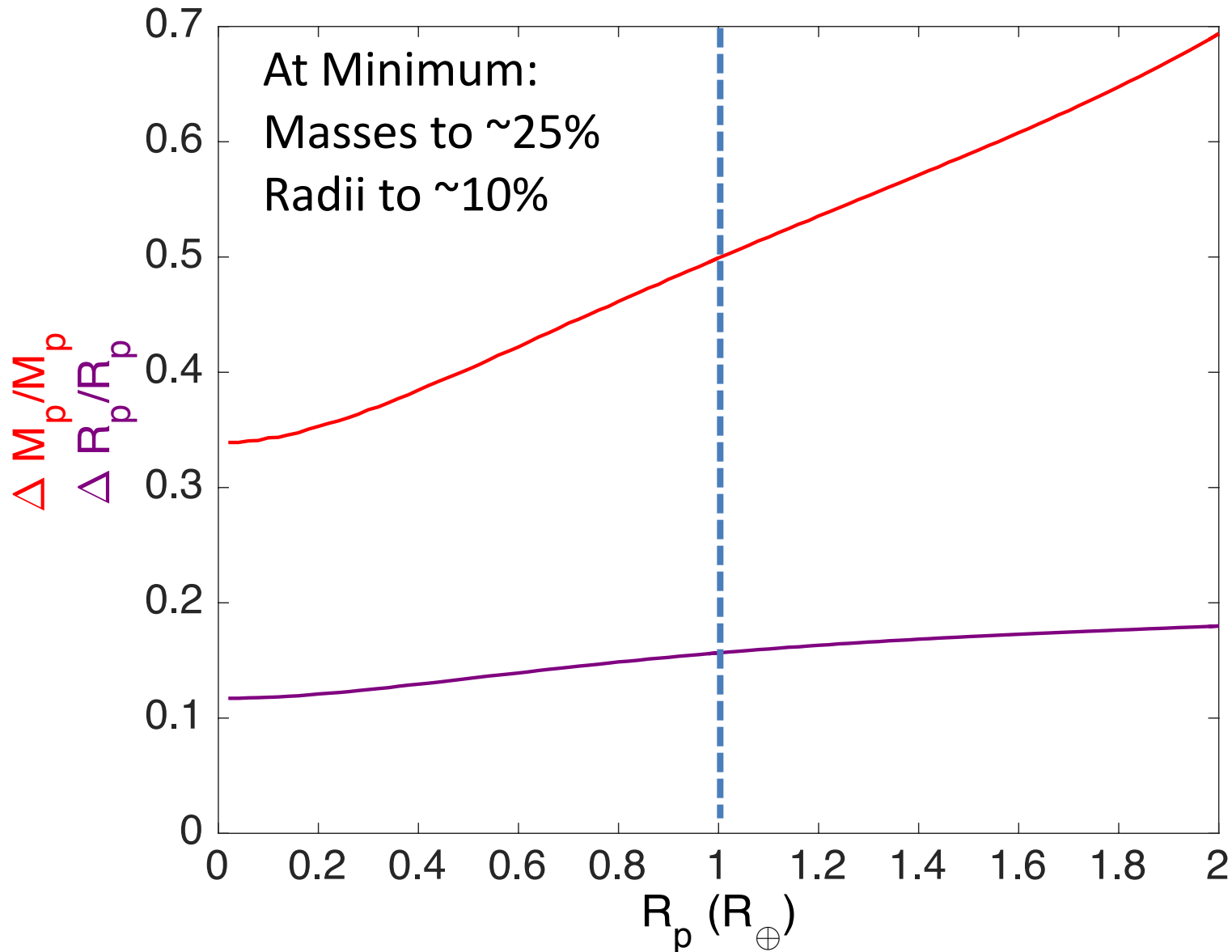
Rocky Planets in M-R Space



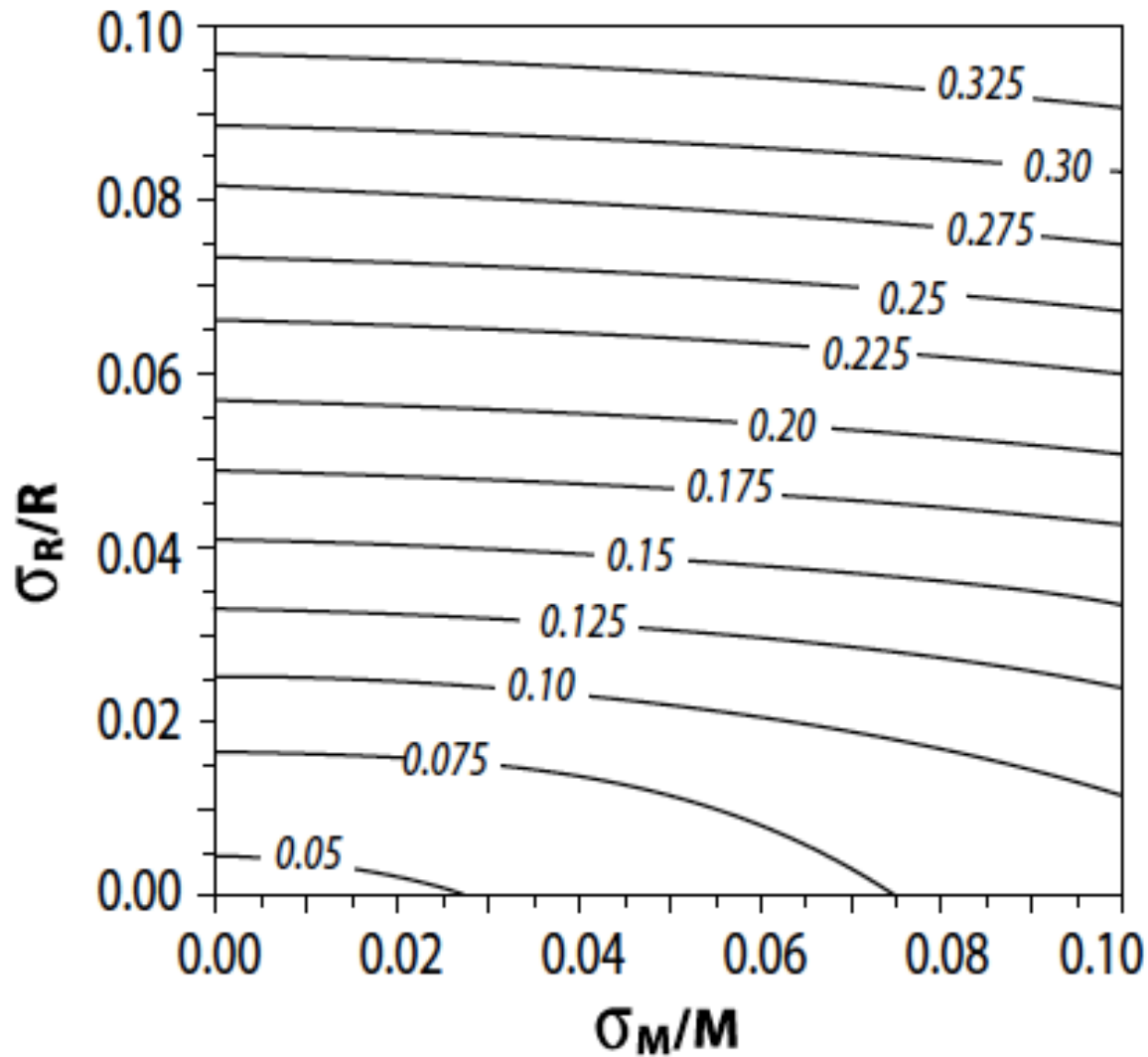
“Rule of Thumb” Baseline M-R Precision



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“Rule of Thumb” Baseline M-R Precision



... For constraining water mass fraction.

How precisely ~~Do~~ We Need to Measure Mass and Radius?

Beyond rough rules of thumb

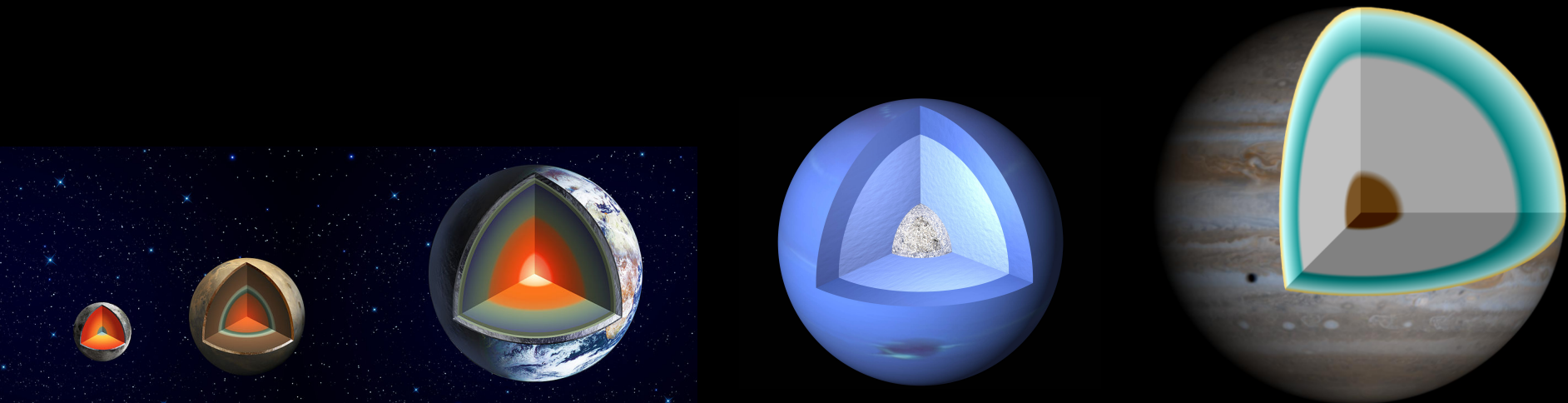
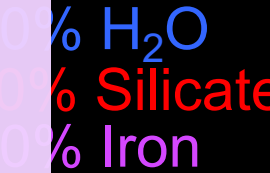


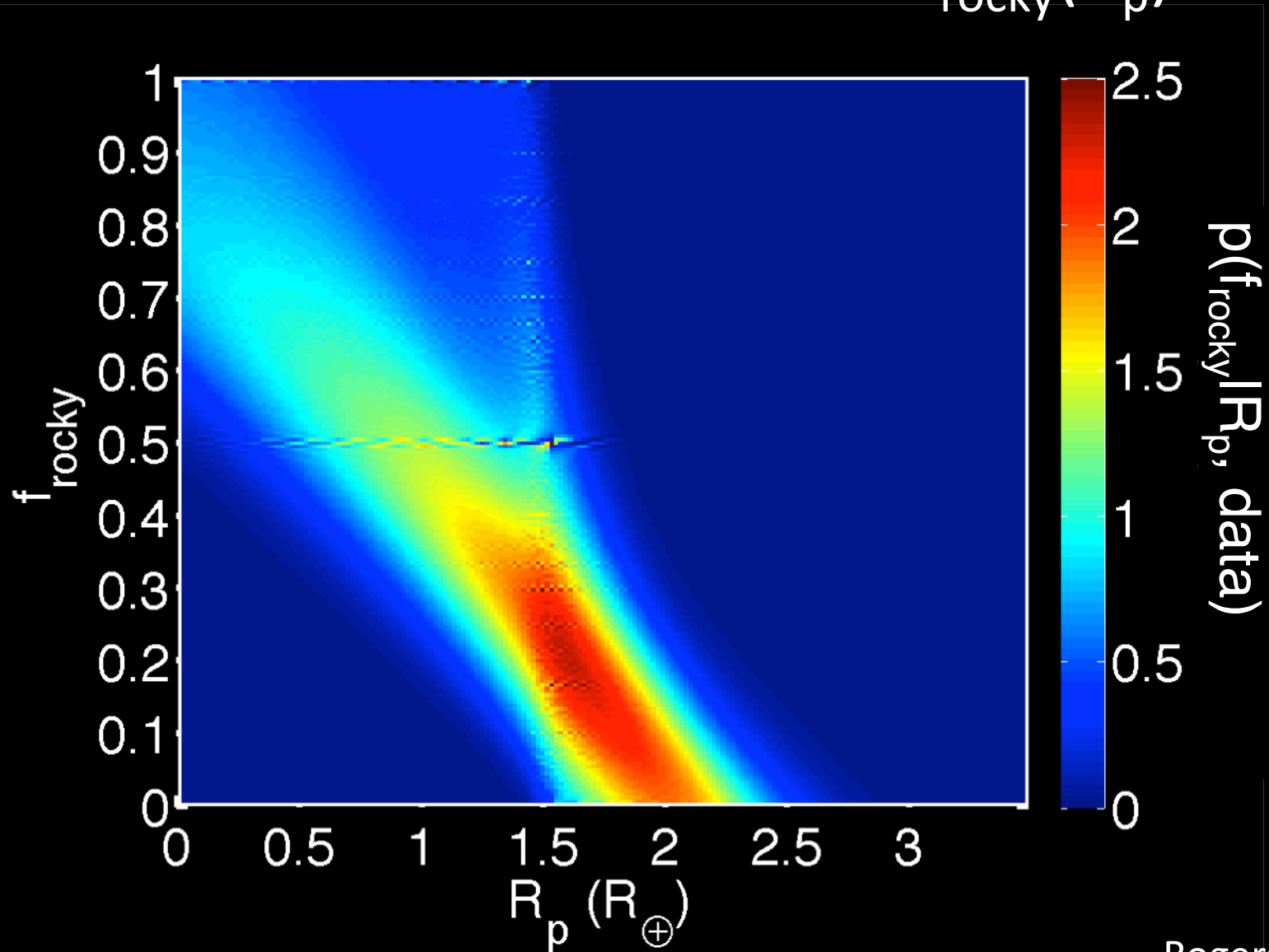
图 1-1-10

- Biases/Selection Effects Dominating current census of M-R
- Getting out to the HZ requires extrapolation in incident flux/host star type
- Rocky exoplanets characterized to date could all be evaporated cores
- Degeneracies



Seager et al. (2007) M-R Relations

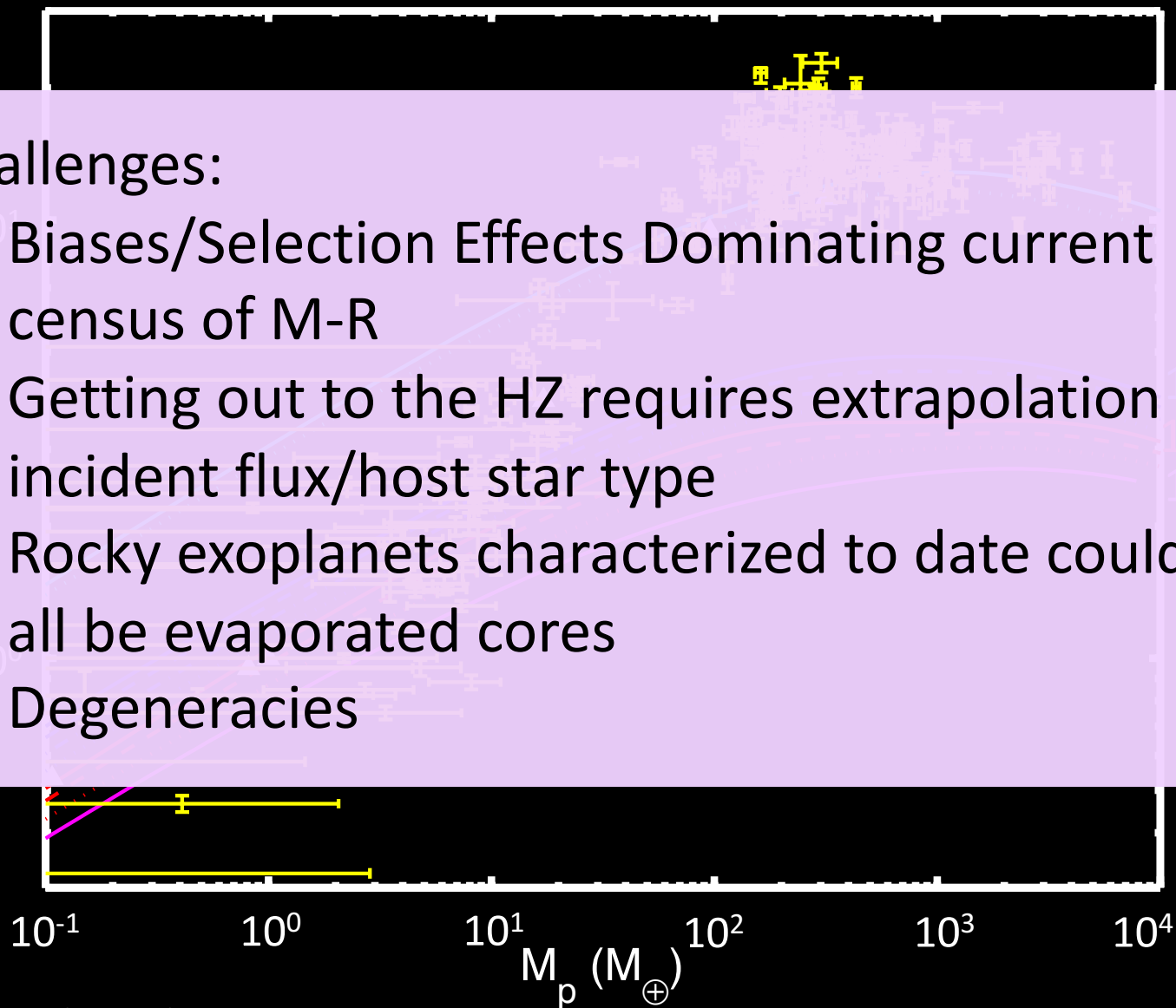
Linear Transition Model: Posterior Distribution for $f_{\text{rocky}}(R_p)$



Use Full Population of Planets to Inform Priors

Challenges:

- Biases/Selection Effects Dominating current census of M-R
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How well can we hope to constrain the planet composition distribution?

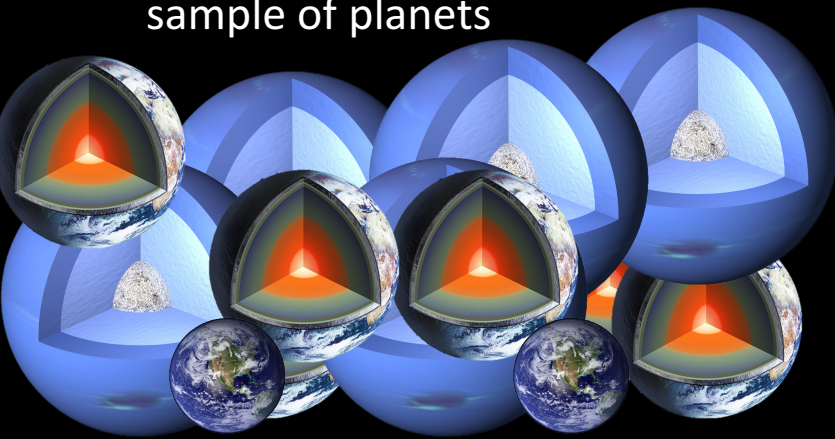
Input Parameters



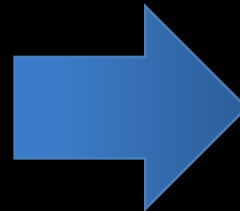
Parameterized Model of
Planet Mass-Composition
Distribution



Generate simulated
sample of planets



Add Noise



Output Parameters



Apply Hierarchical analysis using

Parameterized Model of
Planet Mass-Composition
Distribution



Simulated

$M_p + R_p + F_p$
Measurements

Rogers et al. in prep.

Main Takeaway Points

- Baseline Rule of Thumb: need to measure masses to $\sigma_M/M < 25\%$ and $\sigma_R/R < 10\%$ to help discriminate rocky/non-rocky.
- Of course, constraints on planet composition improve with improving precision.
- Moving forward, will leverage census of accumulating M-R measurements to inform interpretation.