

PLANET FORMATION & COMPOSITION AROUND LOW-MASS STARS

*Yamila Miguel
Leiden Observatory*



Motivation

WHY TO STUDY FORMATION OF PLANETS AROUND SMALL STARS?

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- ▶ *Small stars are the most common*

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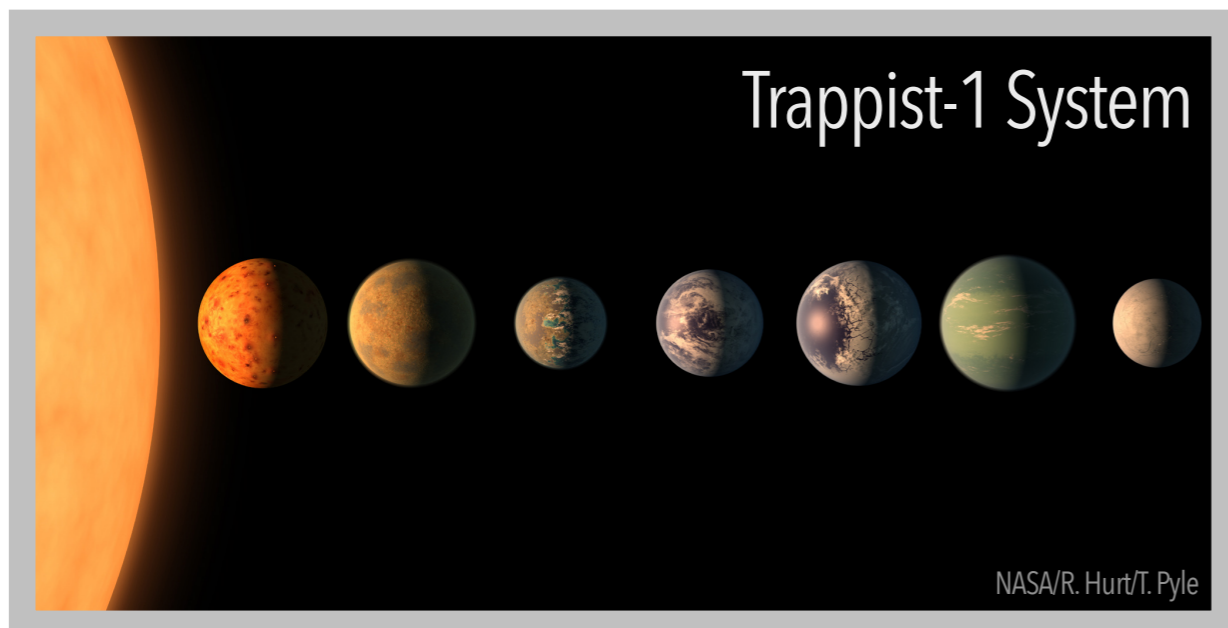
- ▶ *Small stars are the most common*
- ▶ *Rocky planets might be ubiquitous around them*

WHY TO STUDY FORMATION OF PLANETS AROUND SMALL STARS?

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- ▶ *The habitable zone around small stars is closer in and their planets easier to be detected*

WHY TO STUDY FORMATION OF PLANETS AROUND SMALL STARS?

- ▶ *Small stars are the most common*
- ▶ *Rocky planets might be ubiquitous around them*
- ▶ *The habitable zone around small stars is closer in and their planets easier to be detected*
- ▶ *The formation of these systems is poorly known*



Motivation

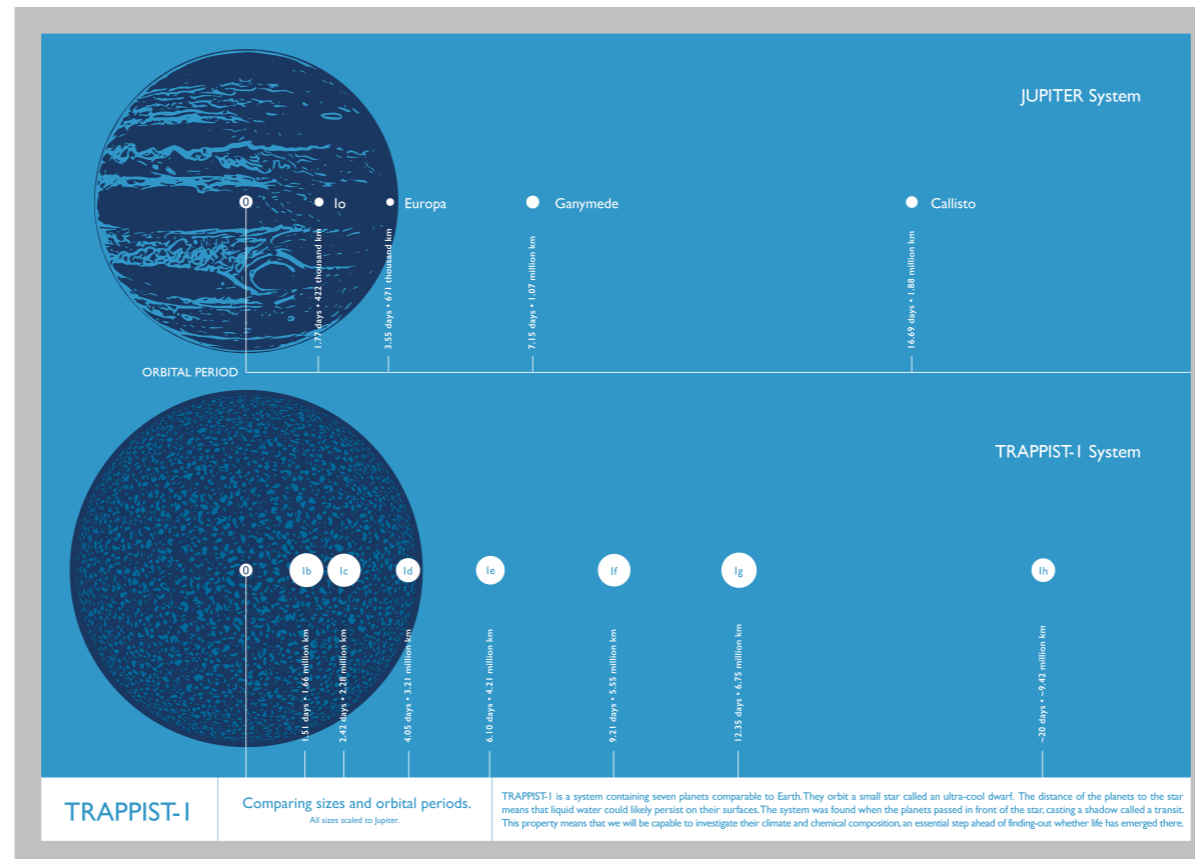
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► *Compact systems, planets with short periods*



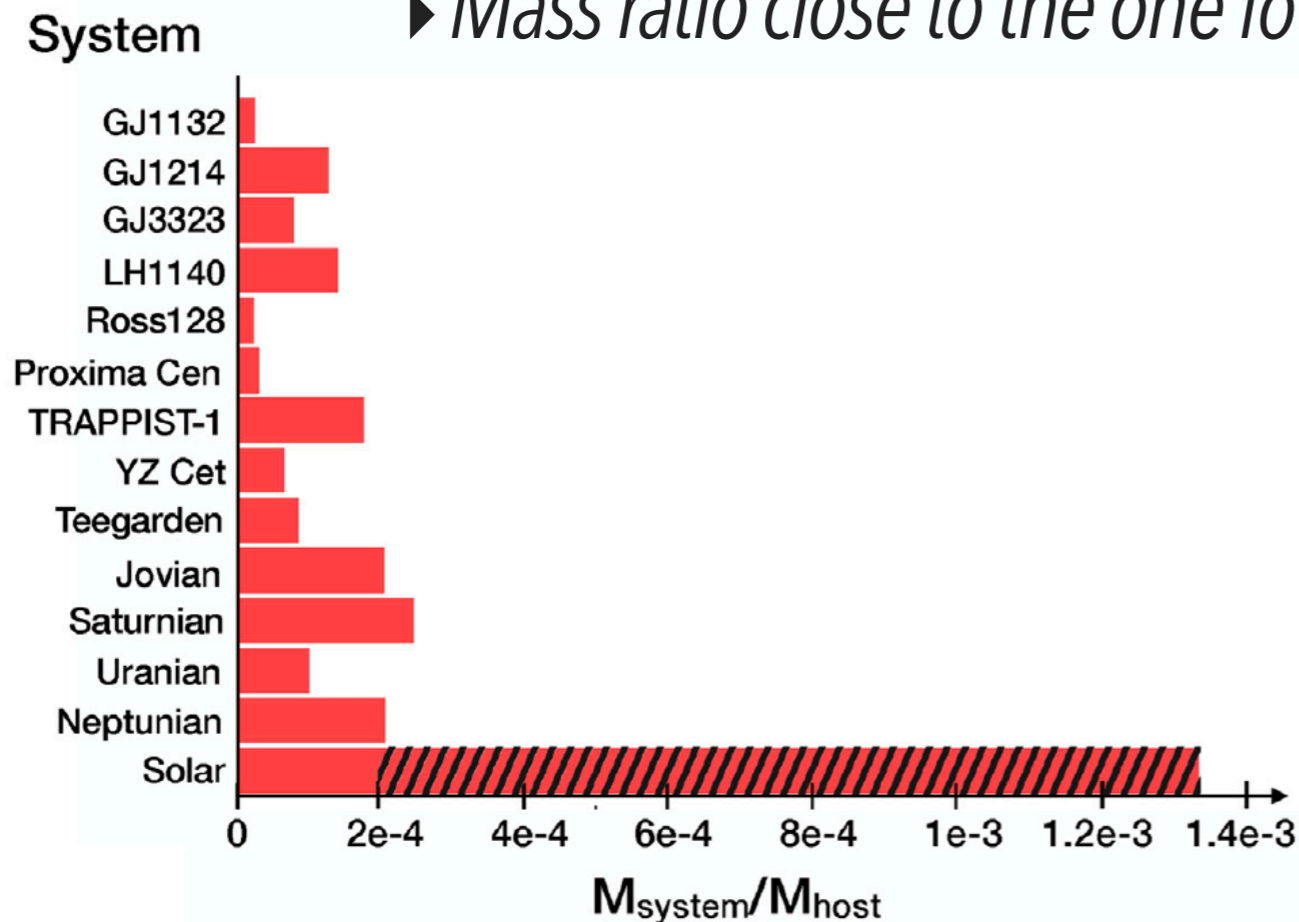
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- ▶ *Compact systems, planets with short periods*
- ▶ *Most planets are rocky with very little gas*
- ▶ *Mass ratio close to the one found in satellites systems*



Method

MODEL FOR FORMATION OF PLANETS AROUND SMALL STARS

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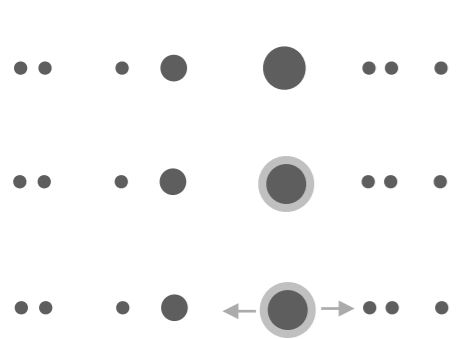


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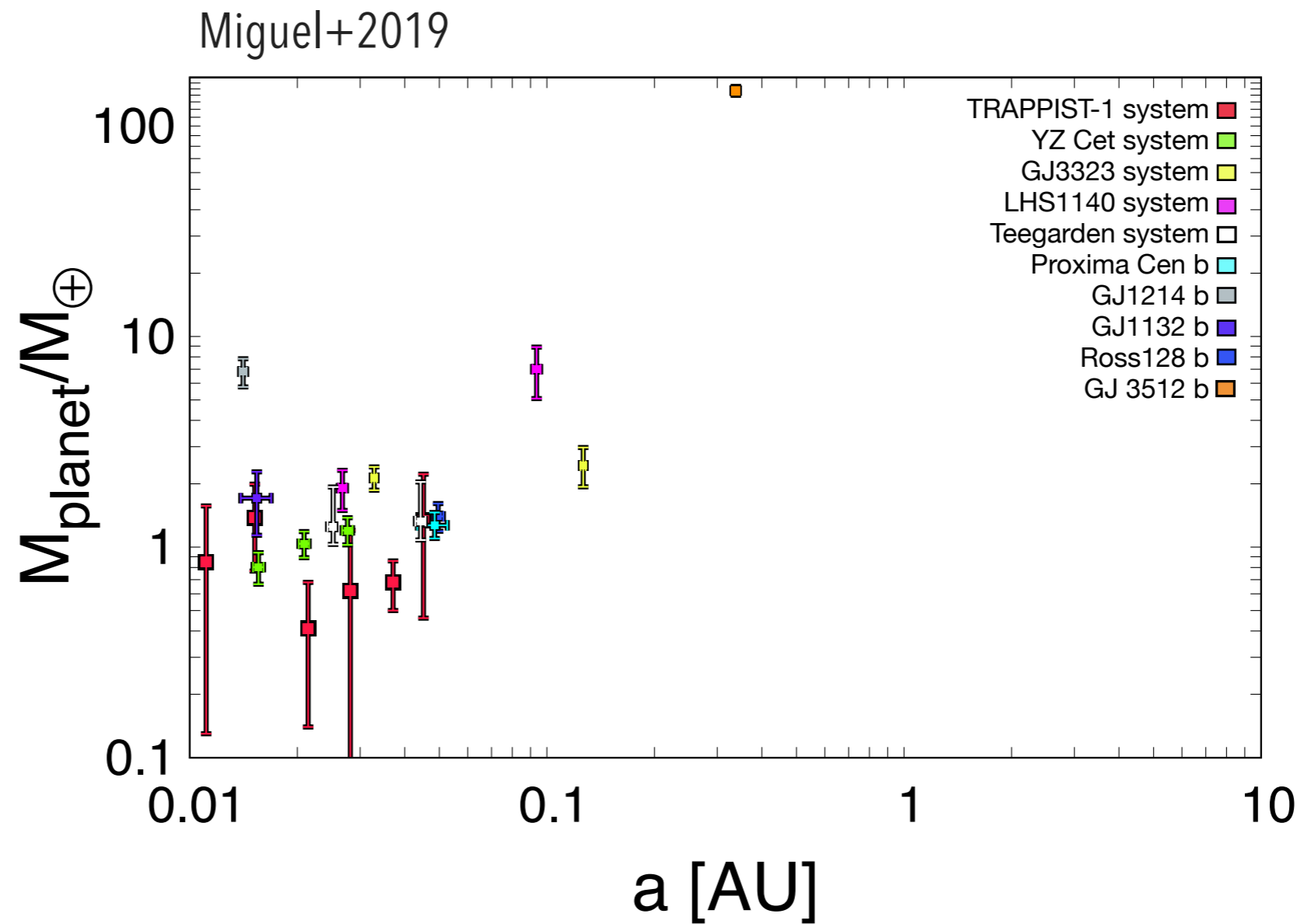
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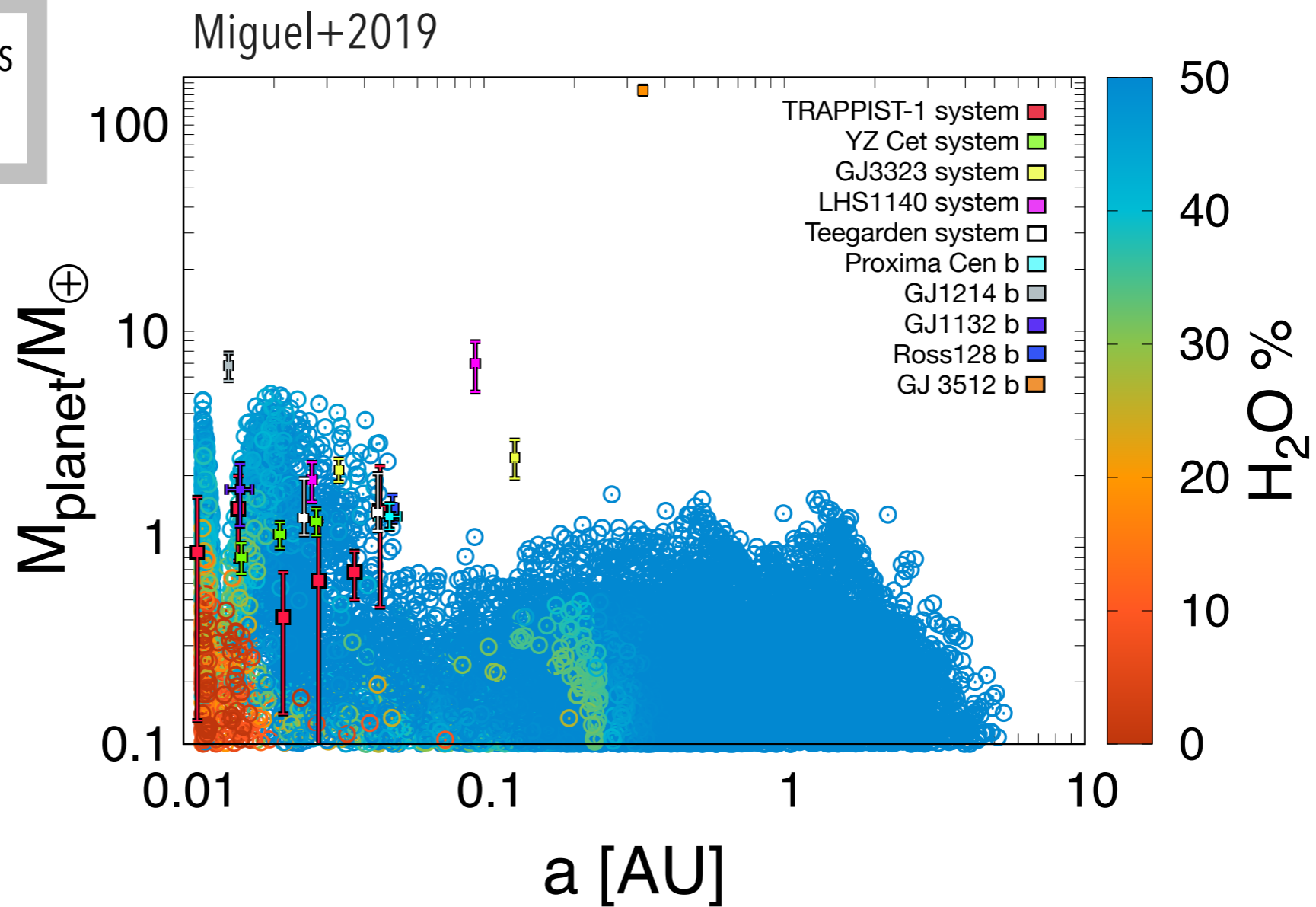
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 - ▶ *Planets can be trapped in regions of zero net torque*
 - ▶ *They can be trapped in resonances*
 - ▶ *They can further evolve through close encounters and collisions after gas dissipation*

MASSES & SEMI-MAJOR AXIS OF THE PLANETS FORMED



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~4000 Planetary Systems
After 10^8 years

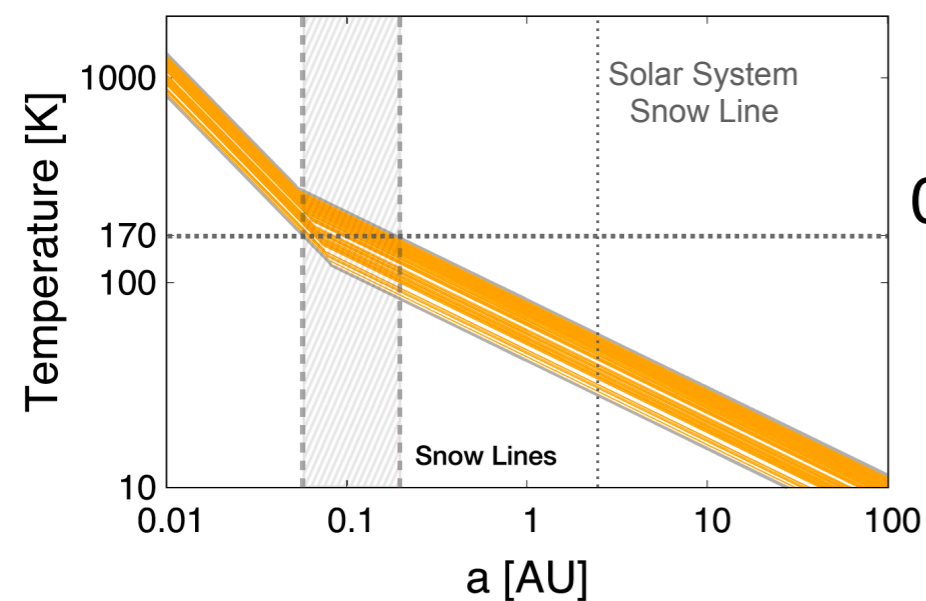
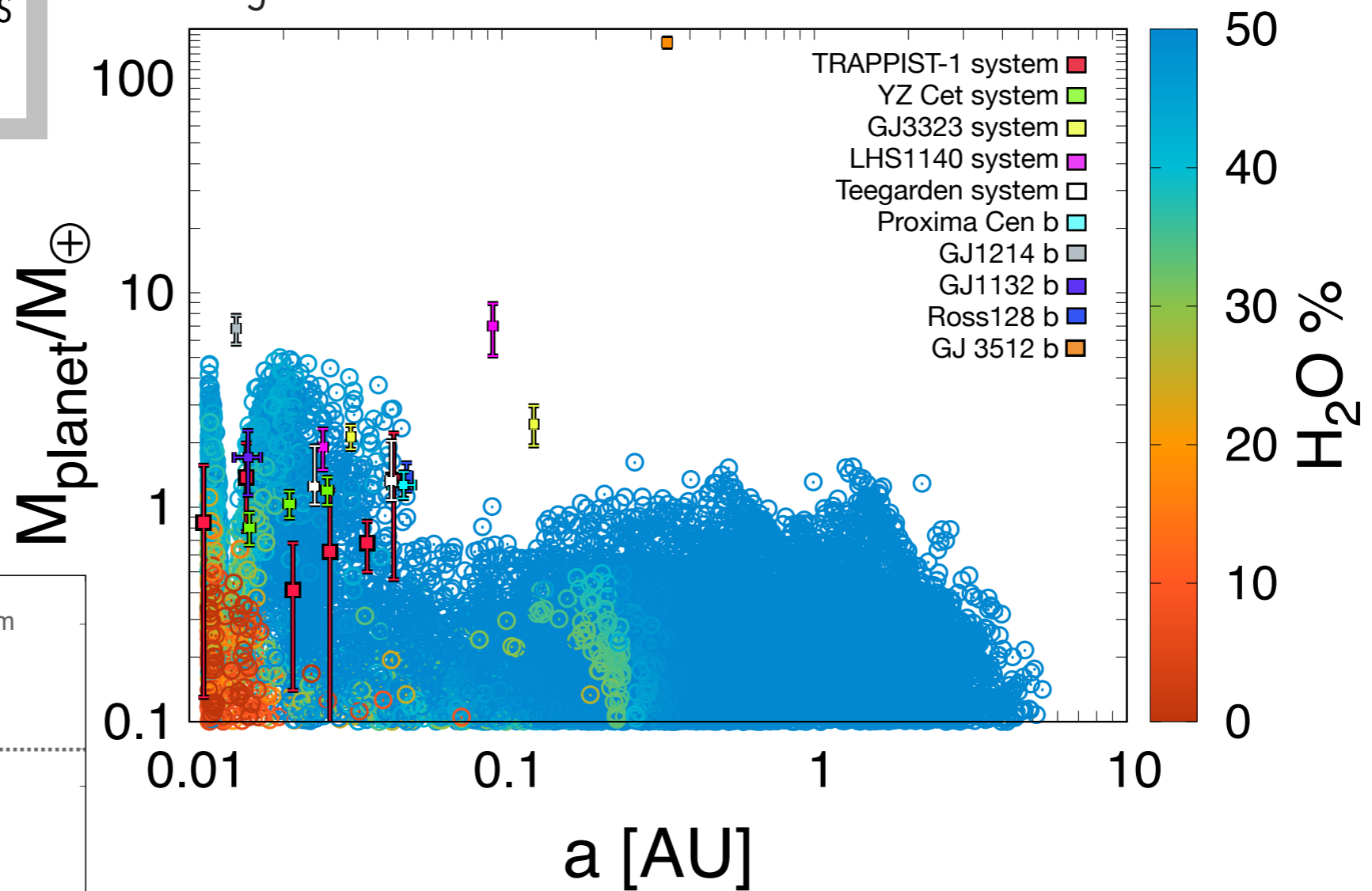


Results

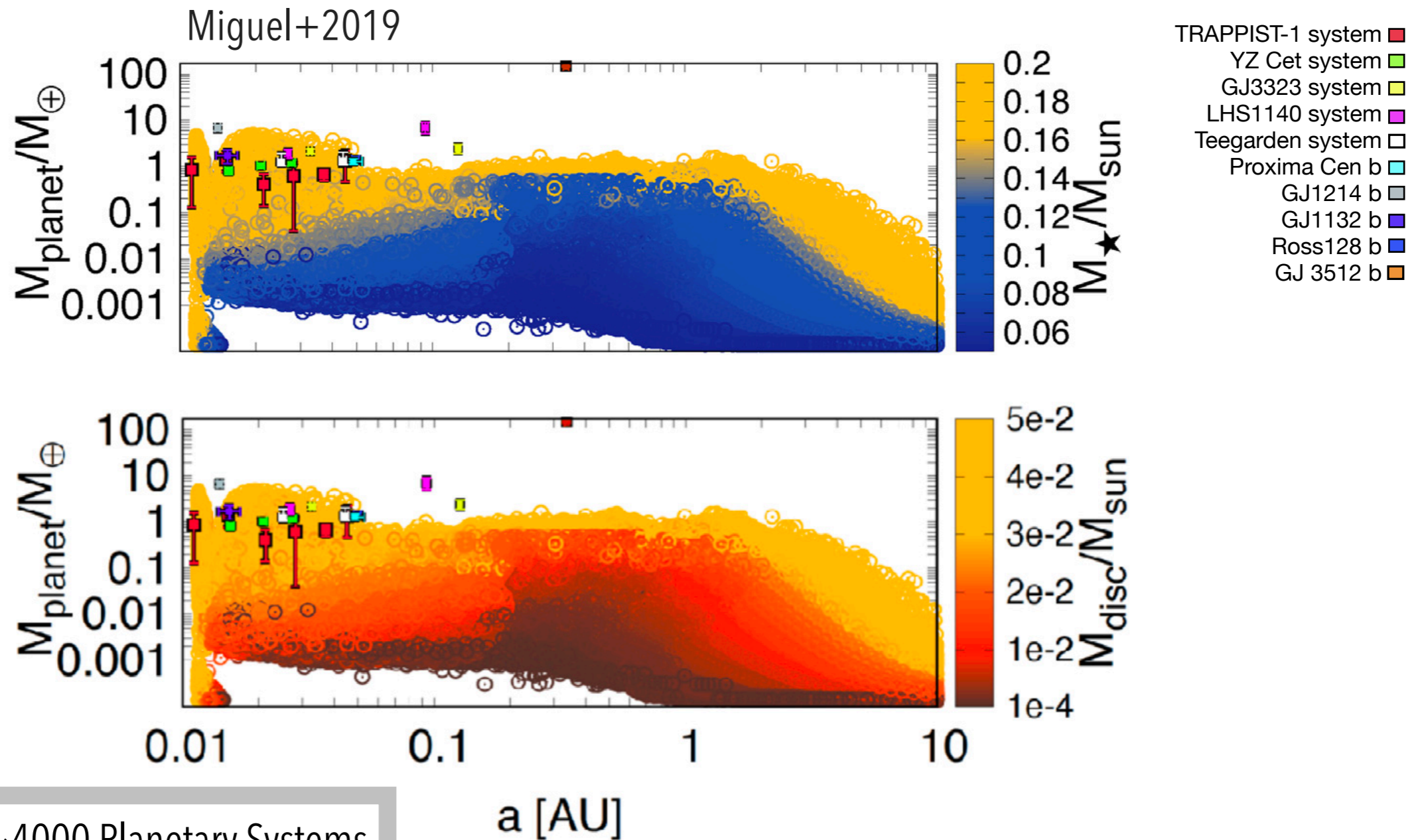
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Miguel+2019



DISKS & STELLAR MASSES

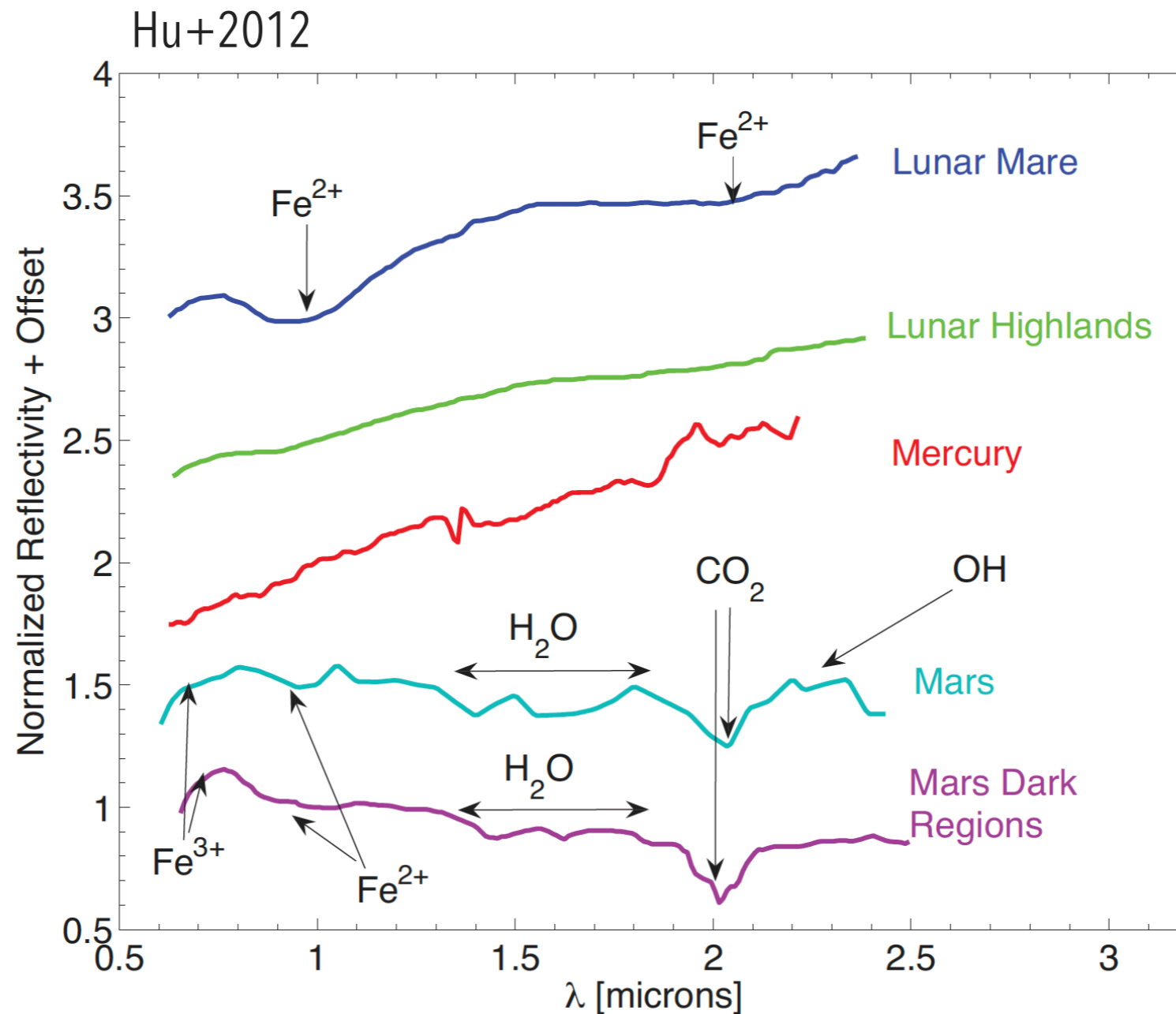


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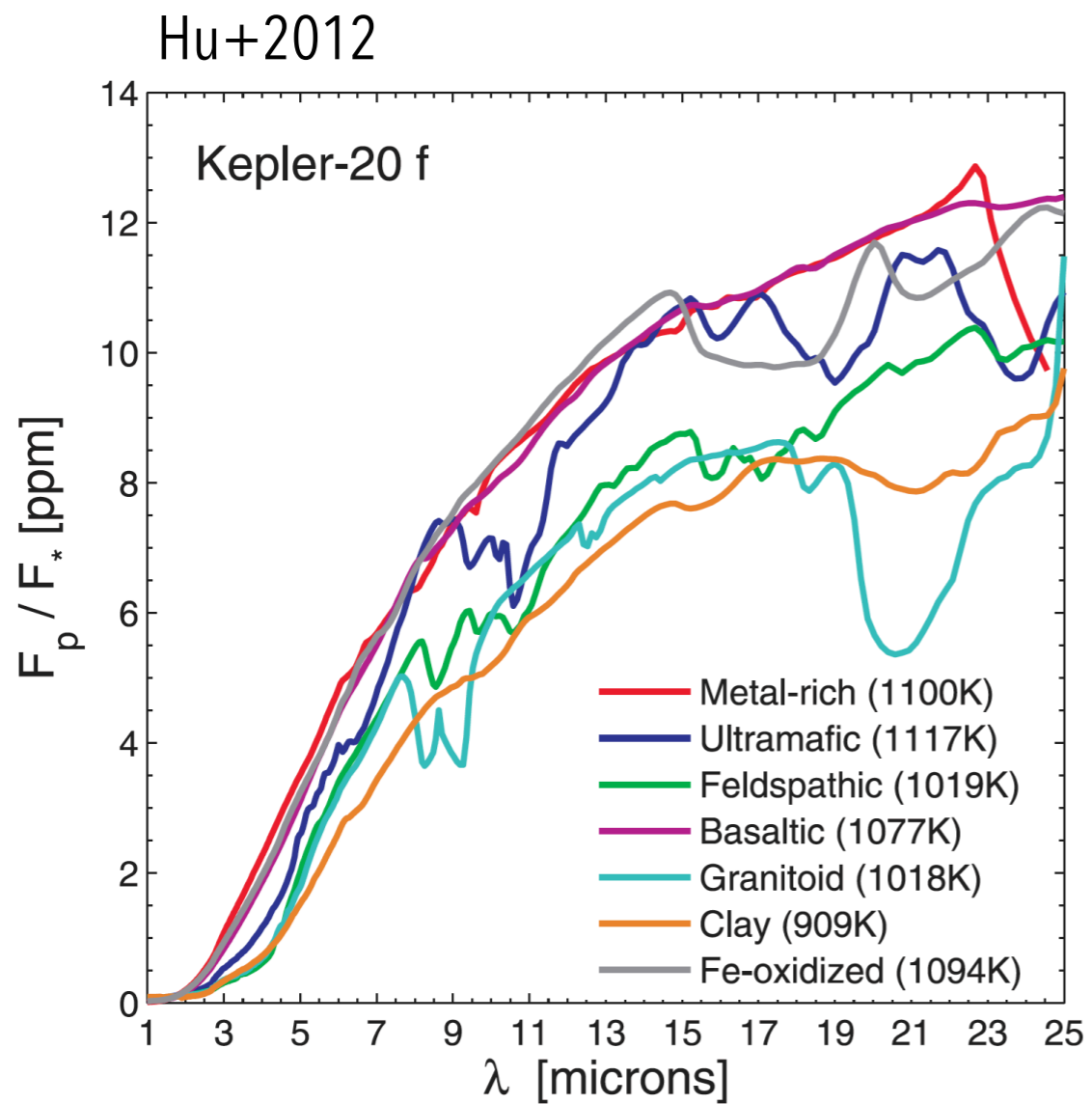
SURFACE CHARACTERISATION WITH ARIEL?

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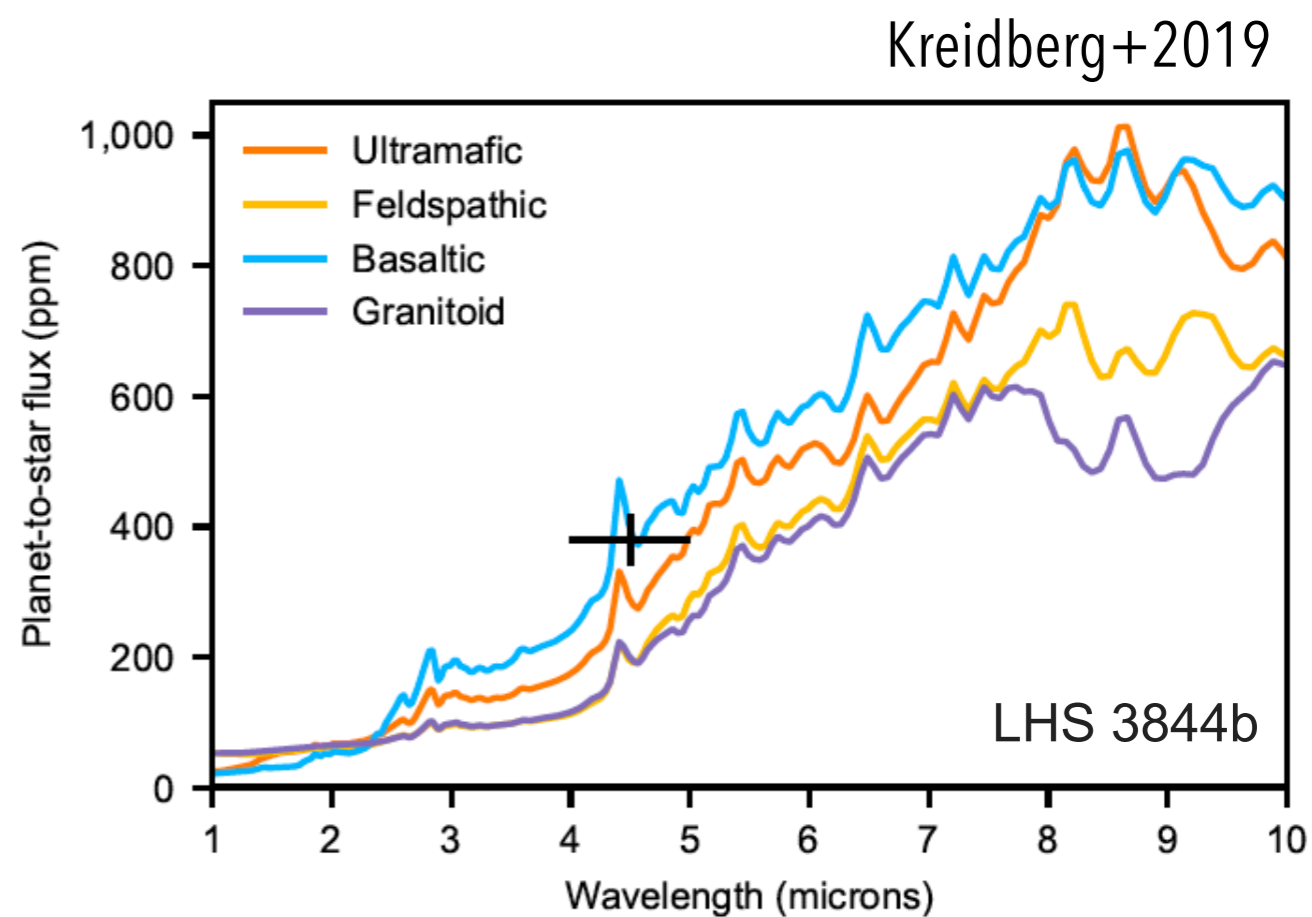
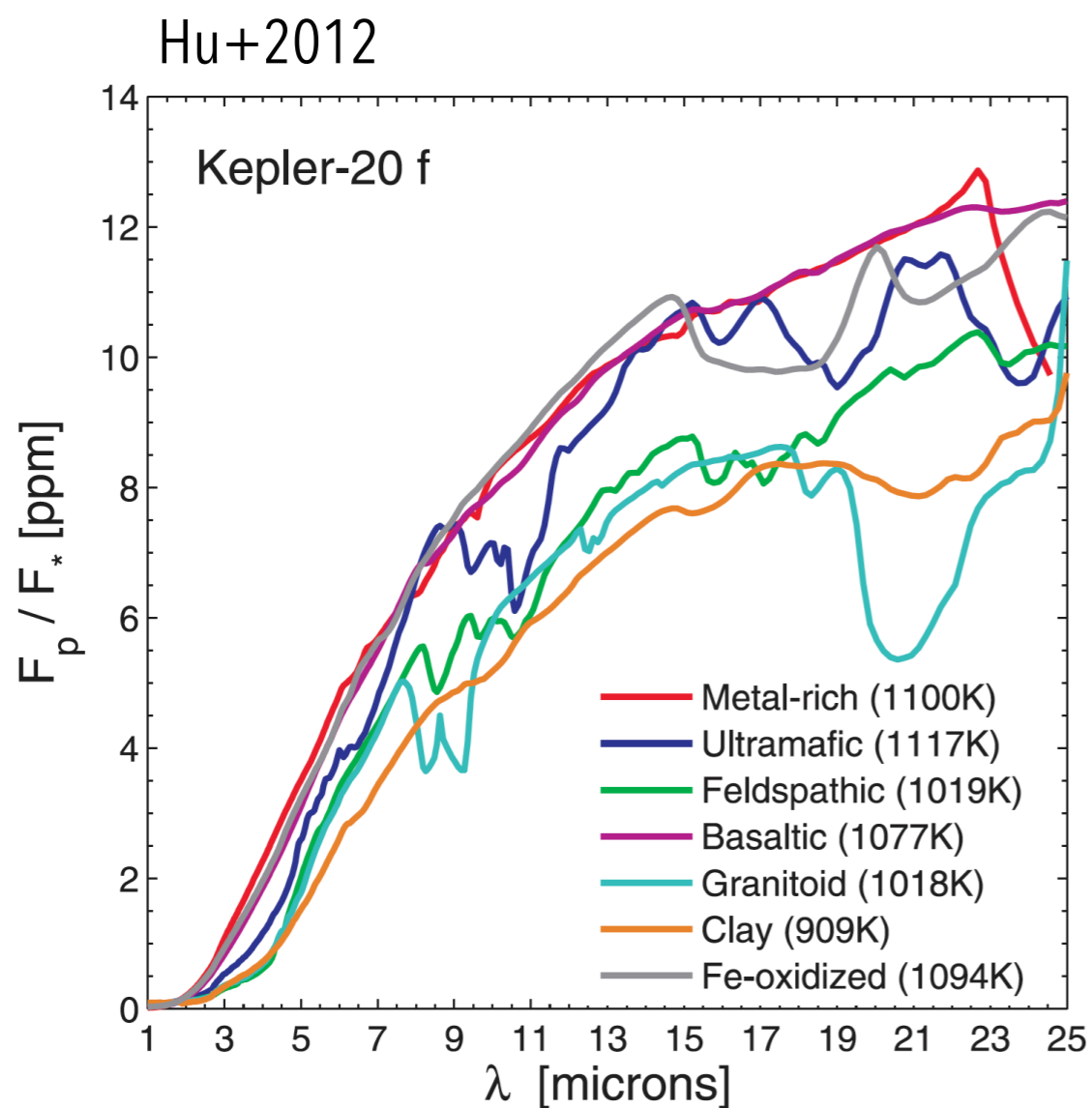
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TAKE HOME MESSAGES

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- ▶ *Compact systems with many planets*
- ▶ *$M_{\star} > 0.07 M_{\odot}$ are needed to form planets larger than Mars*
- ▶ *and $M_{disks} > 0.01 M_{\odot}$, either disks are more massive than thought or large exoplanets form with pebbles?*
- ▶ *Planets are mostly rocky & icy, with no gas, because they don't start gas accretion*
- ▶ *These planets might have no atmosphere, but we might be able to characterise their surfaces with ARIEL*

Yamila Miguel
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Collaborators: Alex Cridland, Chris Ormel, Jonathan Fortney
& Shigeru Ida

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