Building GJ 1132 b

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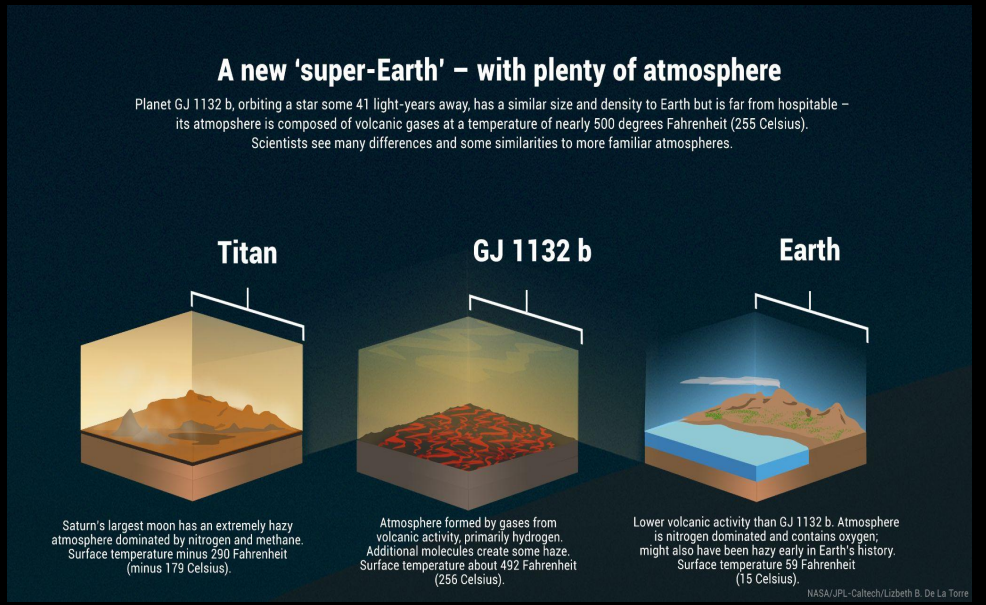
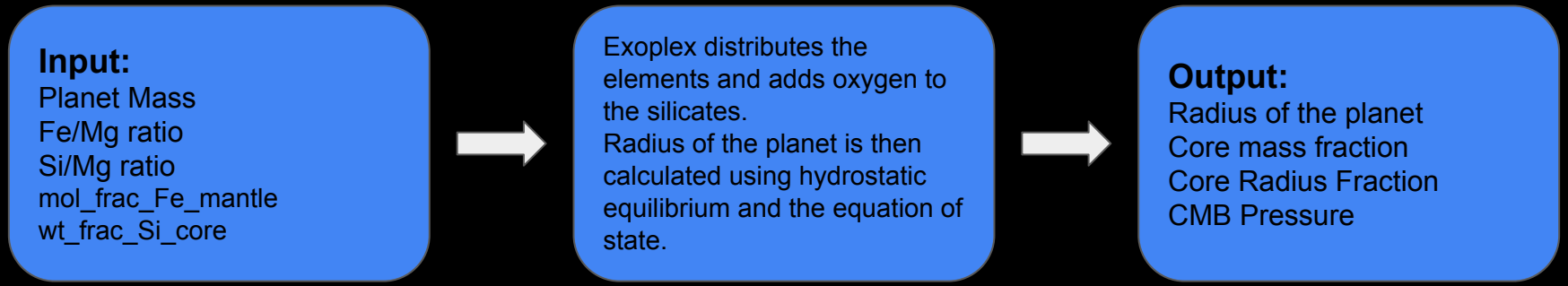
Why build our own planet and why GJ 1132 b?

- GJ 1132 b is relatively close and might have a second atmosphere.
- Can use Exoplex to explore the interior of the rocky planet
- Allows us to see how different parameters affect the planet



What’s Exoplex doing?



How did we do it?

- Assumed planet matches stellar abundance
- Fe/H taken from Berta-Thompson et al. 2015
- Assumed that Mg/H tracked with Fe/H
- Si/Mg = 0.879, Fe/Mg = 0.93

Table 1. Median high-Ia (top) and low-Ia (bottom) sequences for APOGEE DR16+ α-elements and light-Z elements. We calculate medians in bins with a width of 0.1 dex in [Mg/H], requiring > 20 stars per bin. Zero-point shifts discussed in Section 4.1 are included.

[Mg/H]	[O/Mg]	[Na/Mg]	[Al/Mg]	[Si/Mg]	[P/Mg]	[S/Mg]	[K/Mg]	[Ca/Mg]
-0.262	-0.044	0.002	–	-0.085	-0.018	0.022	0.025	–
-0.149	-0.017	0.019	-0.041	-0.036	-0.004	0.022	0.022	0.048
-0.043	-0.022	0.008	-0.090	-0.003	-0.018	0.014	-0.006	-0.028
0.056	-0.012	0.005	-0.044	0.013	-0.017	0.002	-0.029	-0.017
0.153	0.001	-0.003	0.012	0.025	-0.017	-0.004	-0.034	0.007
0.255	0.008	-0.010	0.081	0.026	-0.018	-0.027	-0.041	0.020
0.354	0.013	-0.020	0.170	0.023	-0.014	-0.056	-0.051	0.065
0.445	0.010	-0.030	0.230	0.019	-0.014	-0.070	-0.057	0.073
0.532	-0.000	-0.043	0.266	0.003	-0.021	-0.091	-0.069	0.094

From Griffith et al. 2020

Physicist	Astronomers working galaxies	Astronomers working on stars
Mole ratio between O and H	Log of mole ratio between O and H and add an offset of 12	$log\left(\frac{N_O/N_H}{(N_O/N_H)_\odot}\right)$
N_O/N_H	12 + log(O/H)	[O/H]
5.3×10^{-4}	8.73	0.0

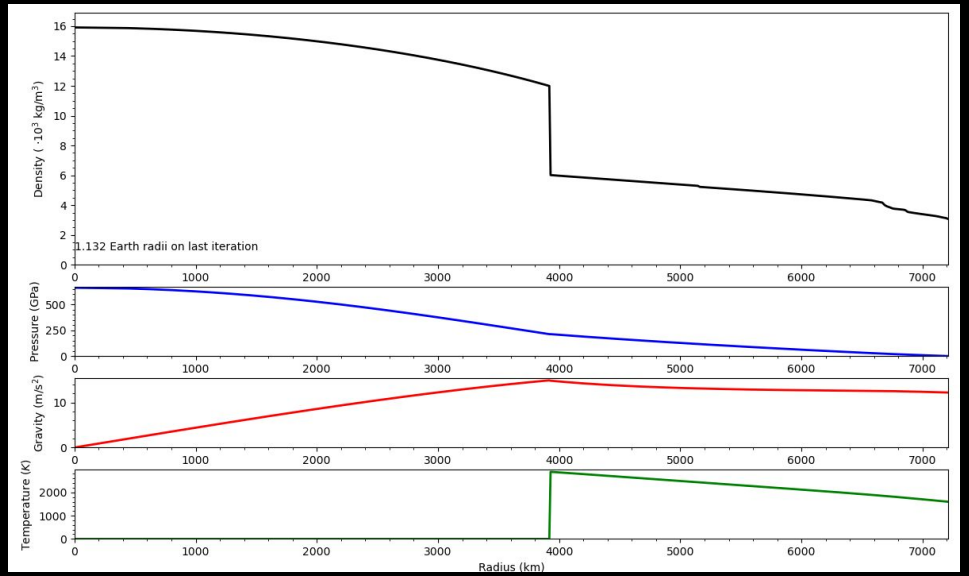
Our Results

From Bonfils et al. 2018

- M_p = 1.66 $M_{\oplus}$, R_p = 1.13 $R_{\oplus}$ and ρ = 6.3 g/cm^3

The closest we get to this is from parameters

- M_p = 1.6 $M_{\oplus}$, Fe/Mg = 0.98, Si/Mg = 0.8
- Results in R_p = 1.132 $R_{\oplus}$ and ρ = 6.03 g/cm^3
- CMF = 36.22
- CRF = 54.50



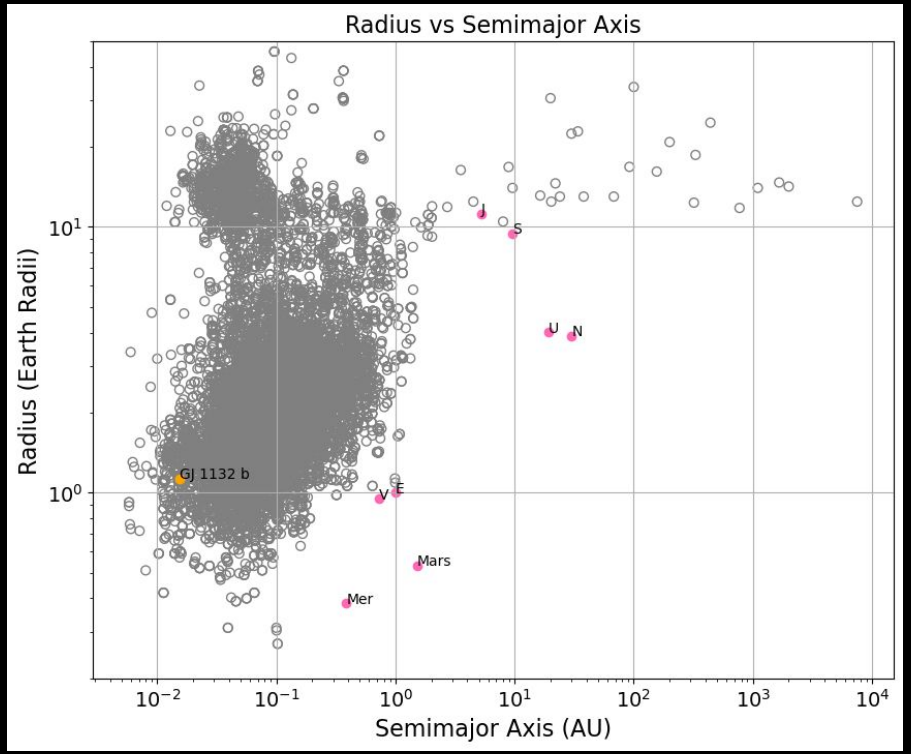
The parameter’s effects

The radius of our planet increases if

- mol_frac_Fe_mantle ↑
- wt_frac_Si_core ↑

The radius decreases if

- Fe/Mg ↑
- Si/Mg ↓



GJ 1132 b vs Earth

- Too close to be in the habitable zone
- Possible secondary atmosphere
- Rampant volcanism might be present
- Interior composition very close to earth

Compound	Earth	GJ 1132 b	Ratio
FeO	0	0	Nan
SiO_2	52.555	49.6126	0.944
MgO	39.171	41.6	1.06
CaO	3.81	4.05	1.06
Al_2O_3	4.46	4.74	1.06

Conclusion

- Strikingly similar composition to Earth
- Tidally locked which leads to tidal heating
- Interesting candidate for atmospheric studies