

A super-Earth transiting a nearby
low-mass star

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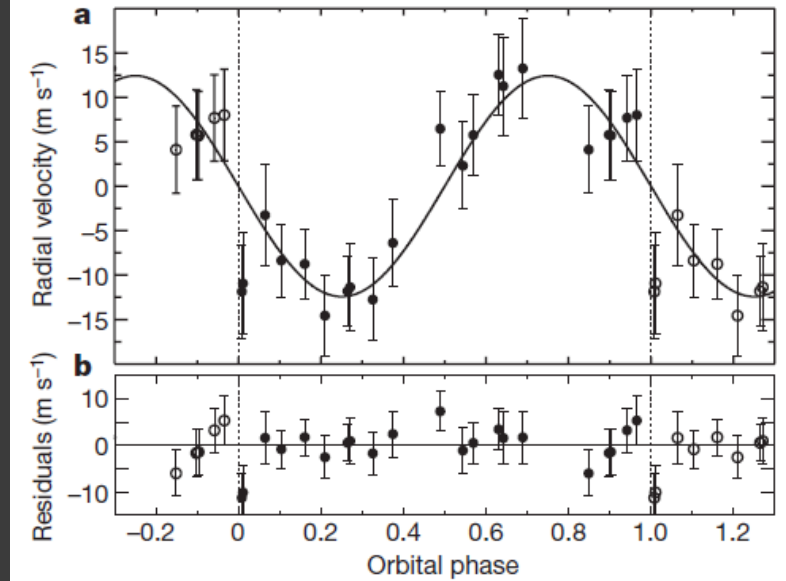
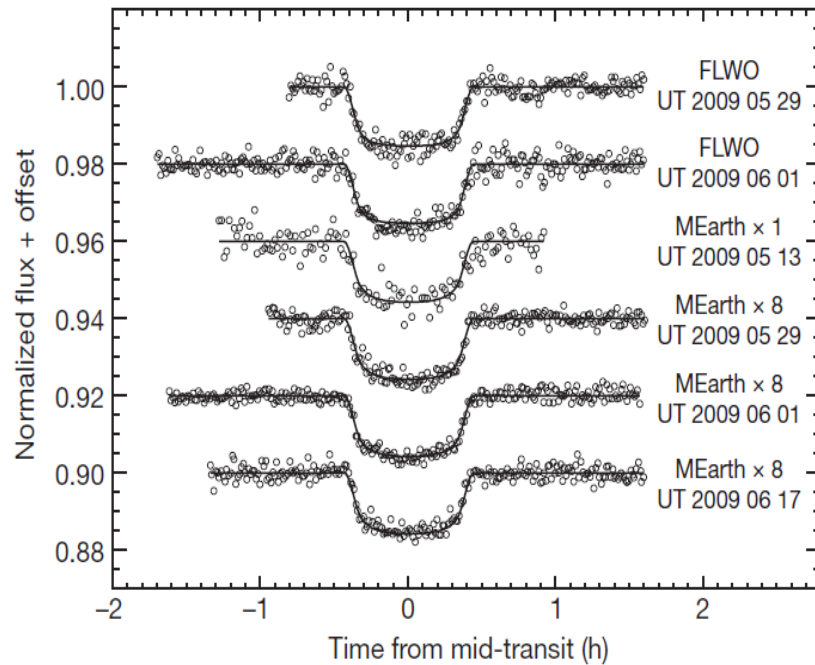
WATER WORLD LARGER THAN EARTH

MEarth Project

- 8 independent automated telescopes (with 0.4m-diameter mirrors)
- Monitoring 2000 nearby M-dwarfs
($0.1 M_{\oplus} < M < 0.35 M_{\oplus}$)
→ search for transiting super-earth
- Wave band : Near infrared (700~900nm)
- GJ 1214b

GJ 1214

Light curves



change in radial velocity

System parameters

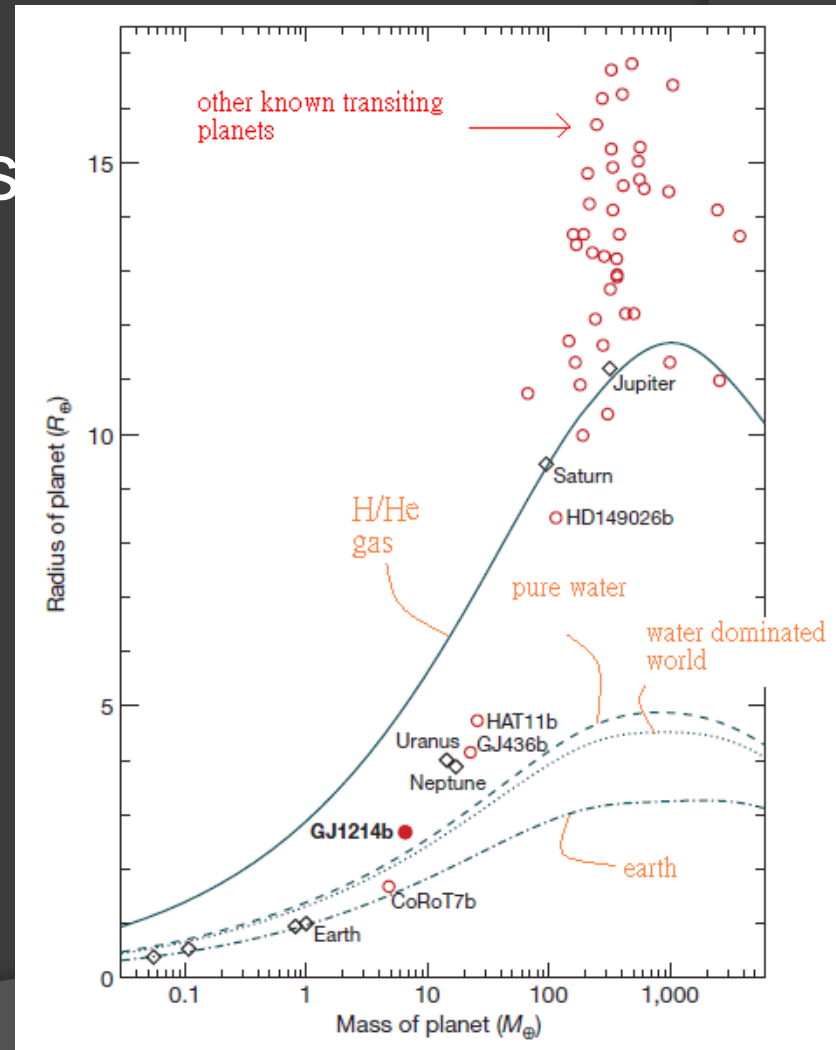
- Planetary density :
~ 1.87 g/cm³
- Compared with earth :
~ 5.5 g/cm³
- CoRoT-7b :
~ 5.6 g/cm³
- What is the composition?

Table 1 | System parameters for GJ 1214

Parameter	Value
Orbital period, P (days)	<u>1.5803925 ± 0.0000117</u>
Times of centre of transit, T_c (HJD)	2454964.944208 ± 0.000403
	2454980.7479702 ± 0.0000903
	2454983.9087558 ± 0.0000901
	2454999.712703 ± 0.000126
Planet/star radius ratio, R_p/R_s	0.1162 ± 0.00067
Scaled semimajor axis, a/R_s	14.66 ± 0.41
Impact parameter, b	0.354 ^{+0.061} _{-0.082}
Orbital inclination, i (deg)	88.62 ^{+0.35} _{-0.28}
Radial velocity semi-amplitude, K (m s ⁻¹)	12.2 ± 1.6
Systemic velocity, γ (m s ⁻¹)	-21,100 ± 1,000
Orbital eccentricity, e	<0.27 (95% confidence)
Stellar mass, M_s	<u>0.157 ± 0.019M_☉</u>
Stellar radius, R_s	0.2110 ± 0.0097R _☉
Stellar density, ρ_s (kg m ⁻³)	23,900 ± 2,100
Log of stellar surface gravity (CGS units), log g_s	4.991 ± 0.029
Stellar projected rotational velocity, $v \sin i$ (km s ⁻¹)	<2.0
Stellar parallax (mas)	77.2 ± 5.4
Stellar photometry	
V	15.1 ± 0.6
I	11.52 ± 0.1
J	9.750 ± 0.024
H	9.094 ± 0.024
K	8.782 ± 0.020
Stellar luminosity, L_s	0.00328 ± 0.00045L _☉
Stellar effective temperature, T_{eff} (K)	3,026 ± 130
Planetary radius, R_p	<u>2.678 ± 0.13R_☉</u>
Planetary mass, M_p	<u>6.55 ± 0.98M_⊕</u>
Planetary density, ρ_p (kg m ⁻³)	<u>1870 ± 400</u>
Planetary surface acceleration under gravity, g_p (m s ⁻²)	8.93 ± 1.3
Planetary equilibrium temperature, T_{eq} (K)	
Assuming a Bond albedo of 0	555
Assuming a Bond albedo of 0.75	393

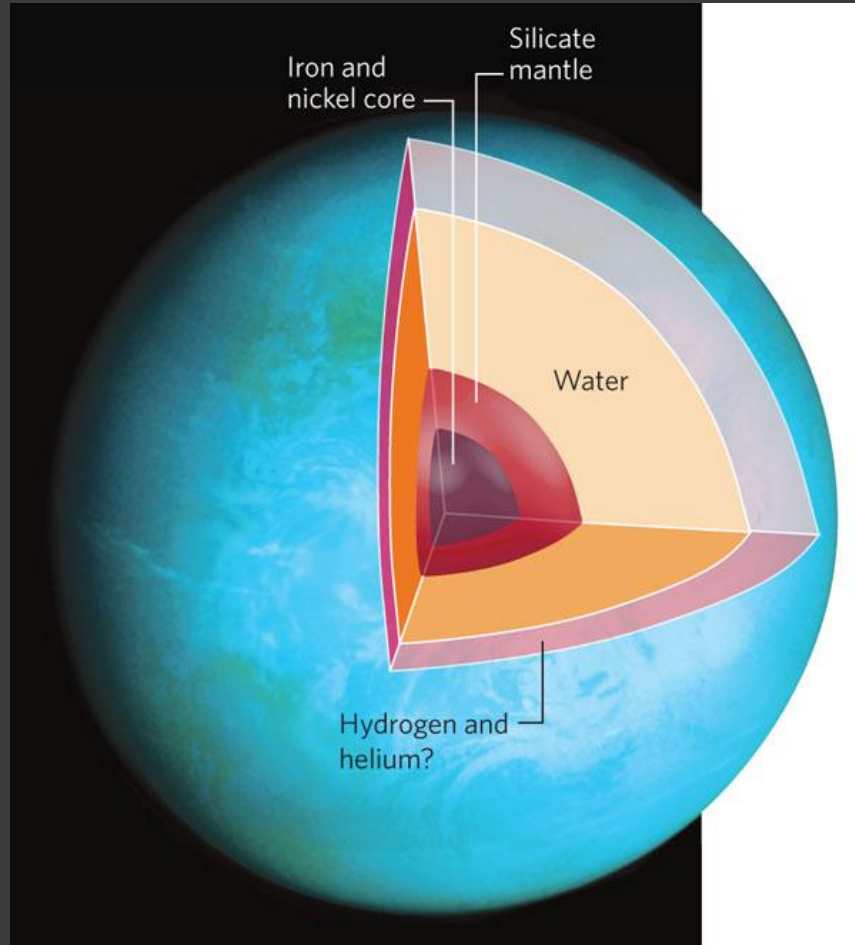
Between earth & ice giants

- Solid surface
→ 50% of water by mass
gaseous envelope
- Comparing
masses and radii
of transiting planets:



Is it kin of our earth?

- Maybe not...





Thank you