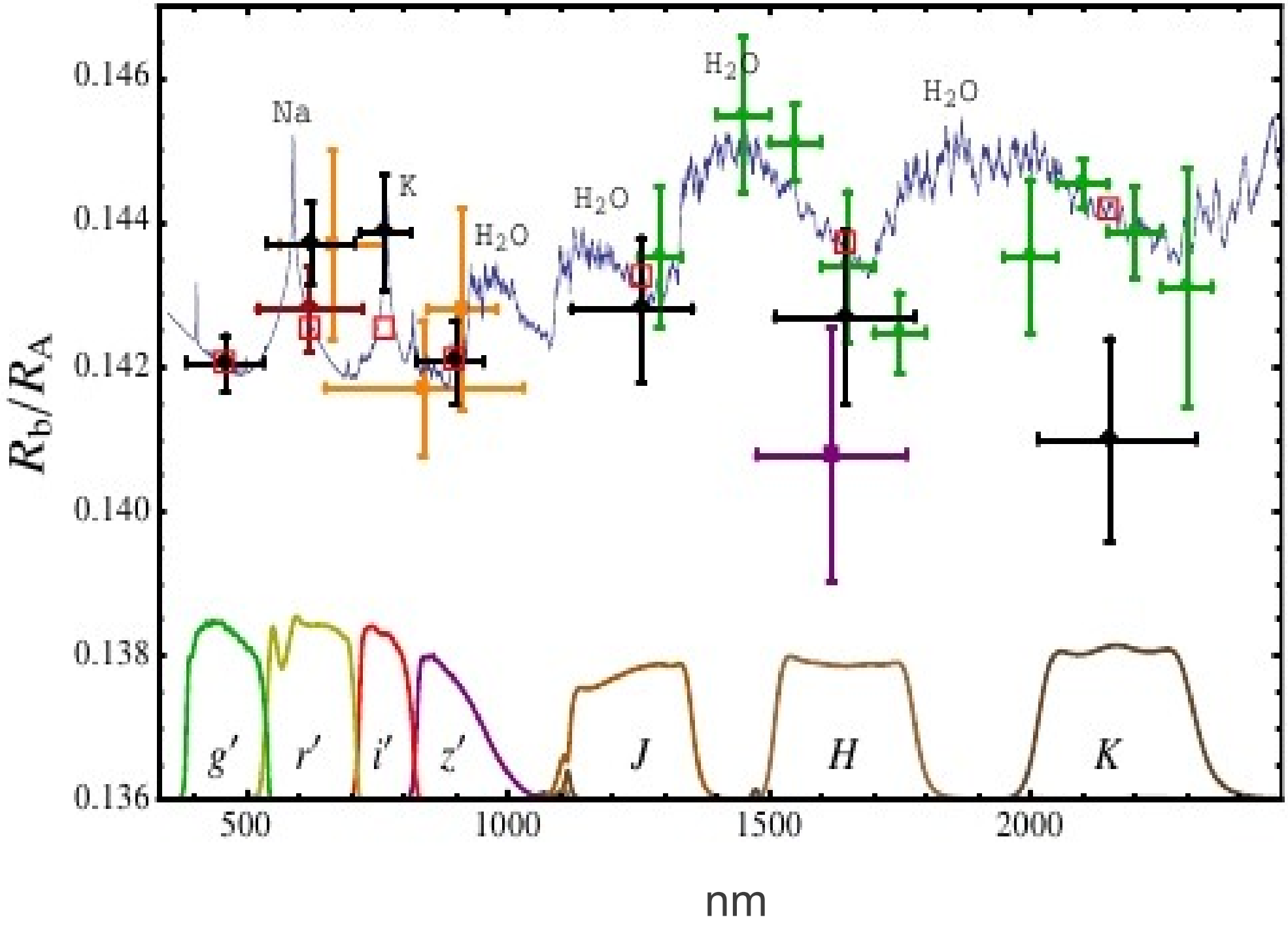

Understanding the Atmospheres of Hot Earths and
the Impact on Solar System Formation
Observations:
Planning

Prospective Targets of Interest- based on density and orbital period.

Planet	Porb (days)	V	a (AU)	M_{Earth}	R_{Earth}
55 Cnc e	0.74	6.0	0.015	7.8-8.3	2.17+/-0.10
Gliese (GJ)581e	3.15	10.6	0.028	5.3	?
Kep20b	3.7	12.5	0.045	8.7+/-2.2	1.91+/-0.2
Kep20c	10.85	12.5	0.093	16.1+/-3.1	3.07+/-0.3
Kep37b	13	9.8	0.10		0.30
Kep37c	21	9.8	0.14		0.74
CoRoT-7b	0.85	11.7	0.017	5.0	1.7
Kep10b	0.84	11?	0.017	4.5	1.4
Kep36b	13.8	11.9	0.115	4.5	1.5
Kep68c	9.6	10.1	0.09	4.4	0.95
Kep9d	1.59	13.9	0.027	?	1.6

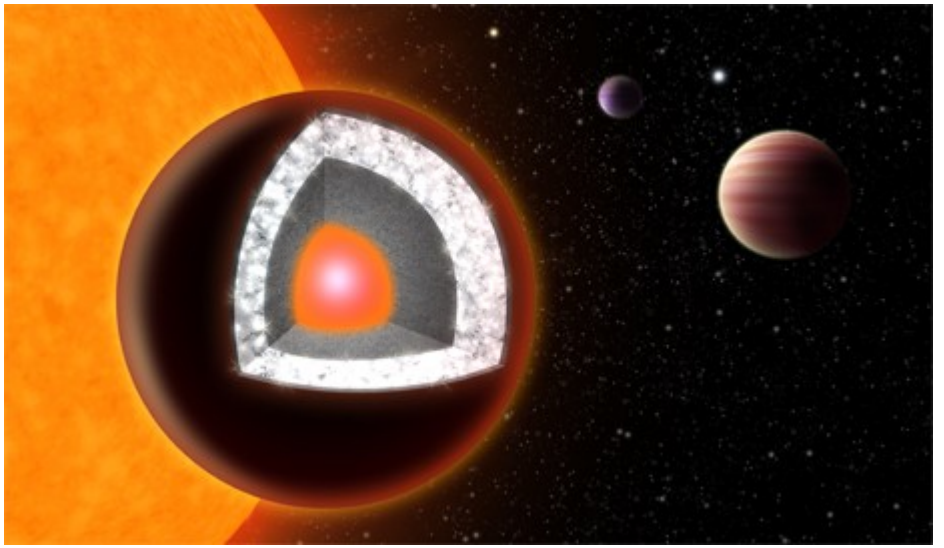

0.146
0.144
0.142
0.140
0.138
0.136
R_b/R_A
Na
K
H_2O
H_2O
H_2O
H_2O
g'
r'
i'
z'
J
H
K
500
1000
1500
2000
nm

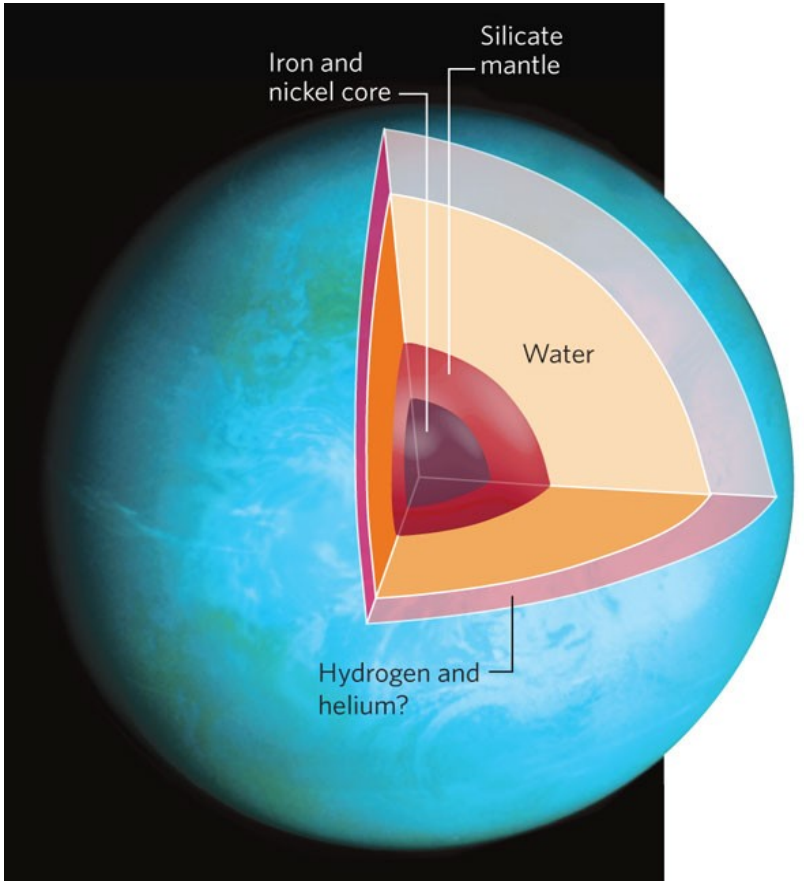
55 Cnc e

$M=7.8M_{Earth}$ $R=2.17R_{Earth}$

ρ = 4.8 g/cc V=6

Graphite surface or steamy water atmosphere?





Kepler 9d

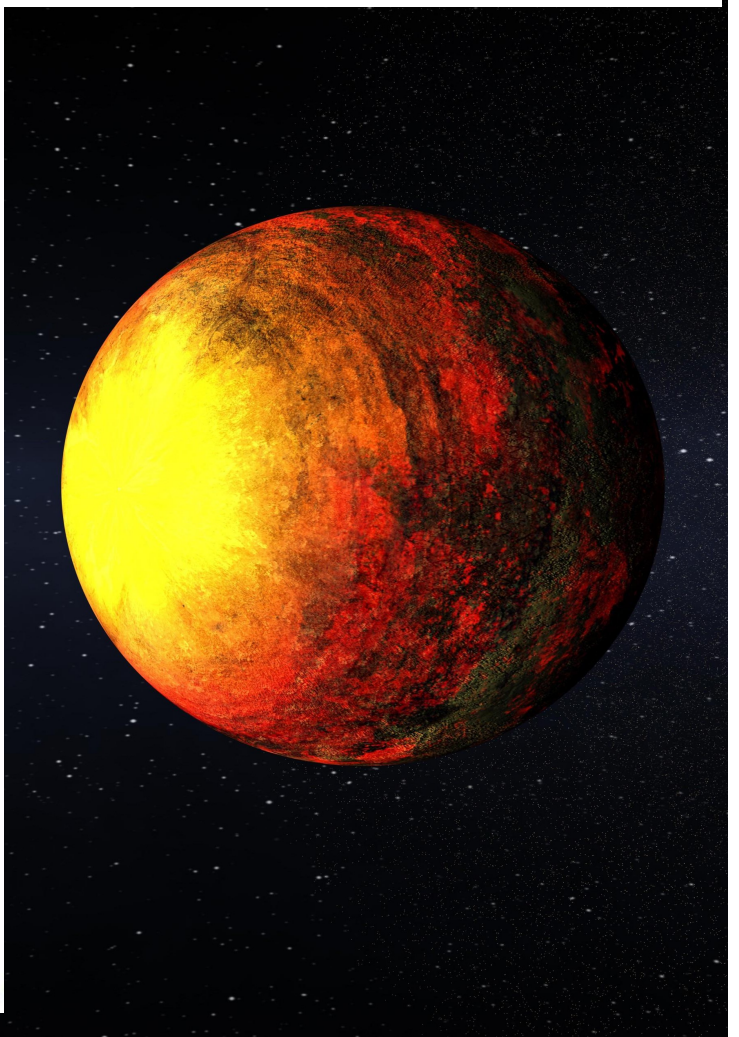
Alternative designation used in catalogues: KOI-377
Distance from Earth: about 700 parsecs
Mass = 1.07 M_{sun}
Radius = 1.02 R_{sun}
Effective temperature T_{eff} = 5,777 K
Metallicity [Fe/H] = 0.12
Kepler magnitude = 13.3
Celestial coordinates

RA = 19h 2min 17.76s,
Dec = +38° 24' 3.2"

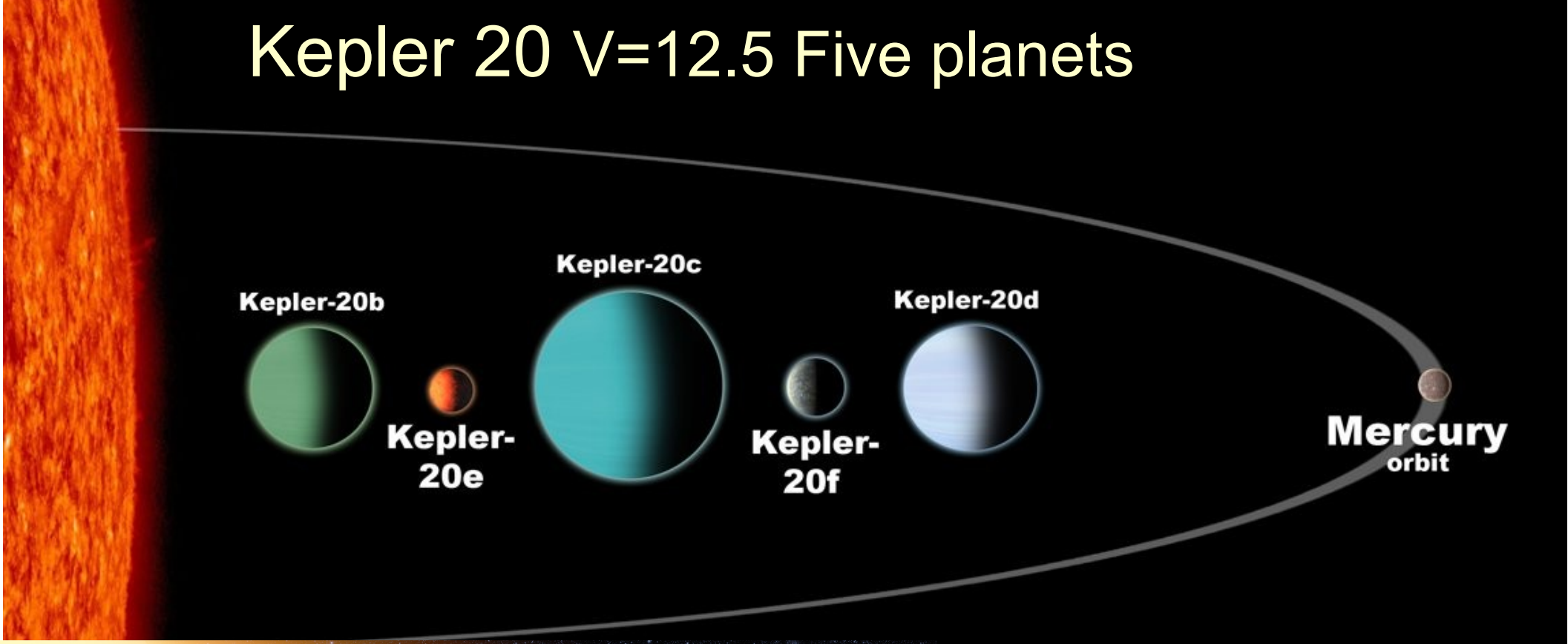
TABLE 7
DERIVED PROPERTIES OF KEPL

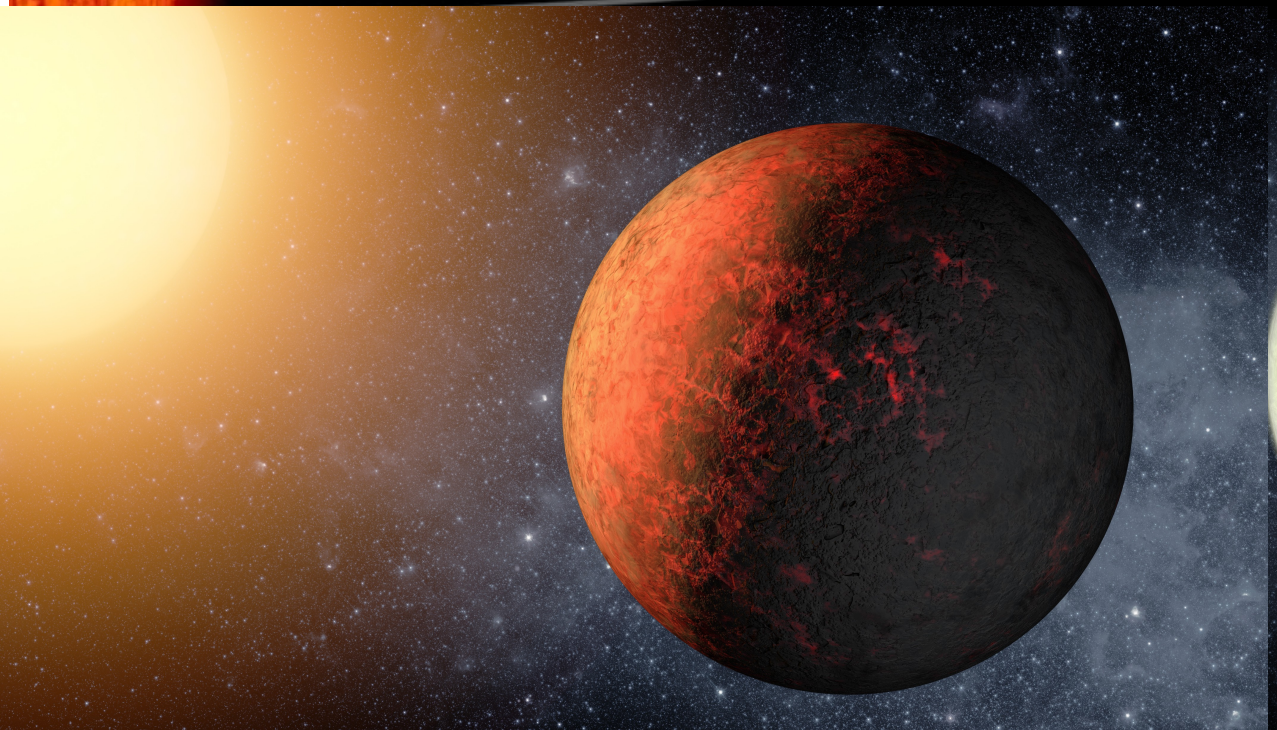
Parameter	Value[a]
Orbital period (days)	1.592851 ± 0.000045
Mid-transit epoch (BJD)	$2{,}455{,}015.0943^{+0.0018}_{-0.0033}$
Orbital semimajor axis (AU)	$0.02730^{+0.00042}_{-0.00043}$
Transit duration (hours)[b]	$1.97^{+0.13}_{-0.17}$
$R_p/R_\star$	$0.0147^{+0.0015}_{-0.0011}$
R_p $(R_\oplus)$	$1.64^{+0.19}_{-0.14}$
$a/R_\star$[c]	$5.54^{+0.51}_{-2.36}$
Equilibrium temperature (K)[d]	2026 ± 60

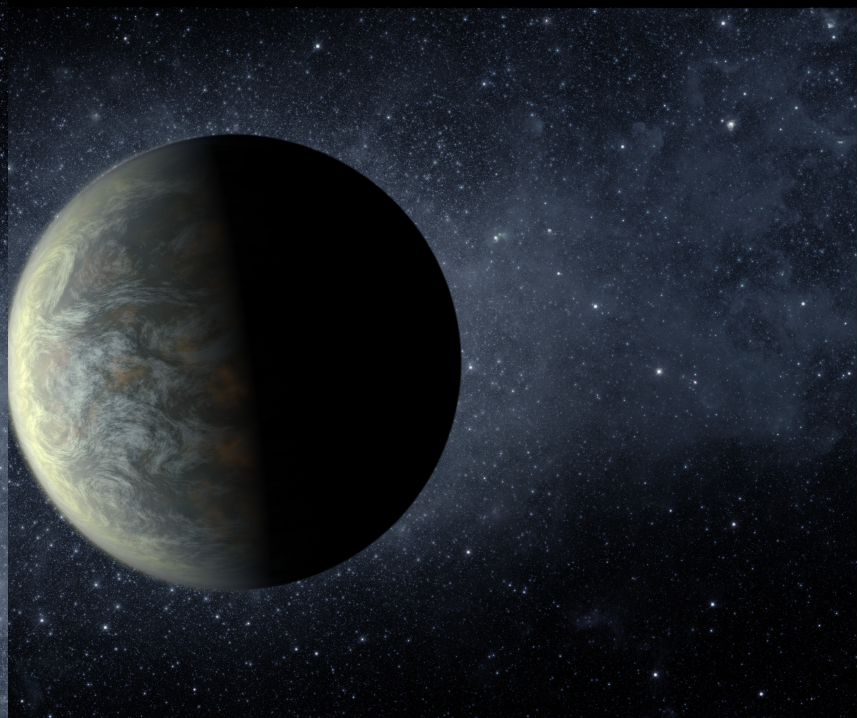
[a] Values and uncertainties correspond to the mode and 1-σ confidence levels derived from the mode of the *a posteriori* distributions generated with the Markov Chain Monte Carlo algorithm.
[b] Defined here as the time interval between the first and last contacts.
[c] The calculation of the normalized semimajor axis assumes the orbit is circular.
[d] Zero-albedo equilibrium temperature ignoring the energy redistribution factor.

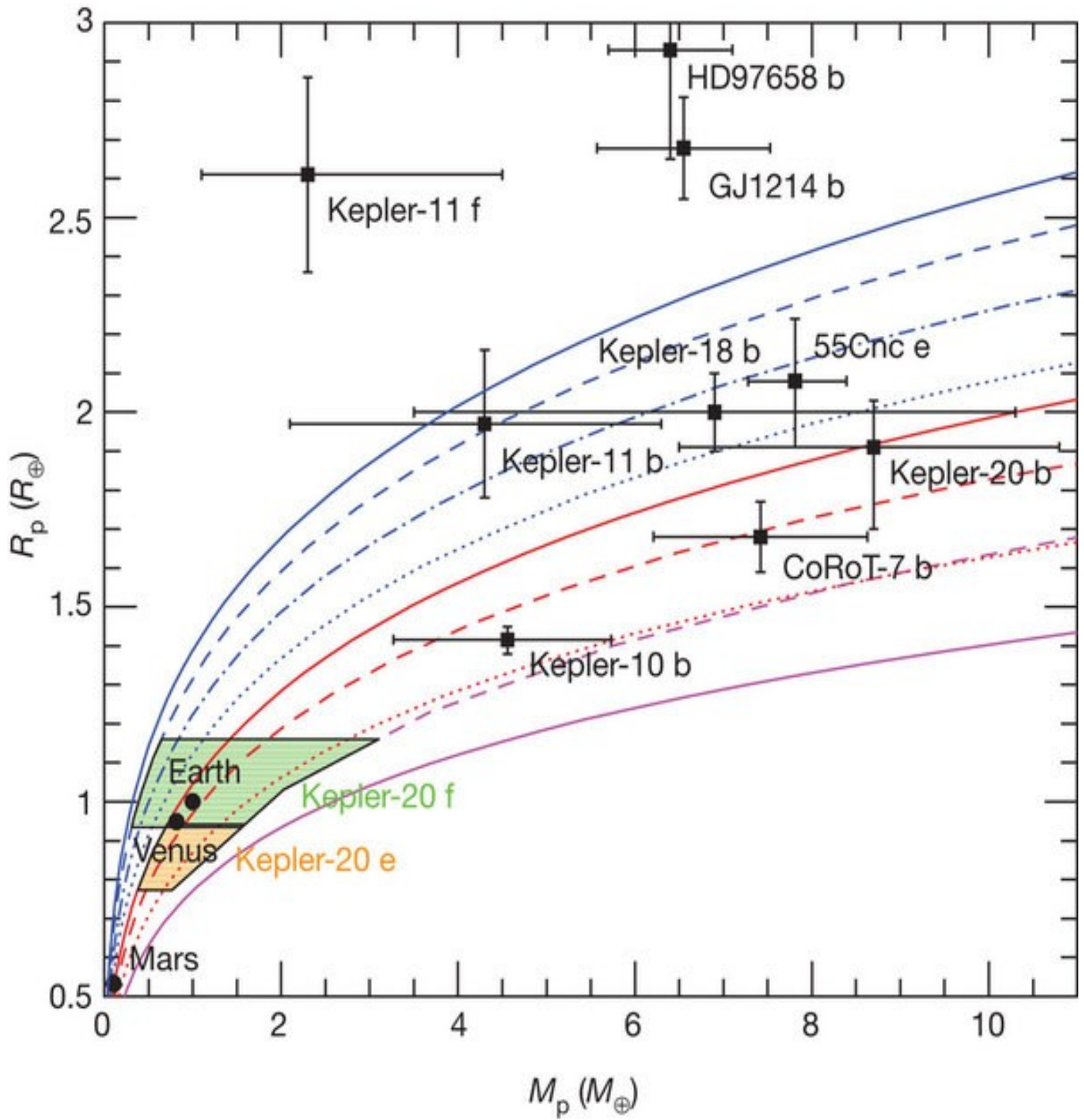


Kepler 20 V=12.5 Five planets

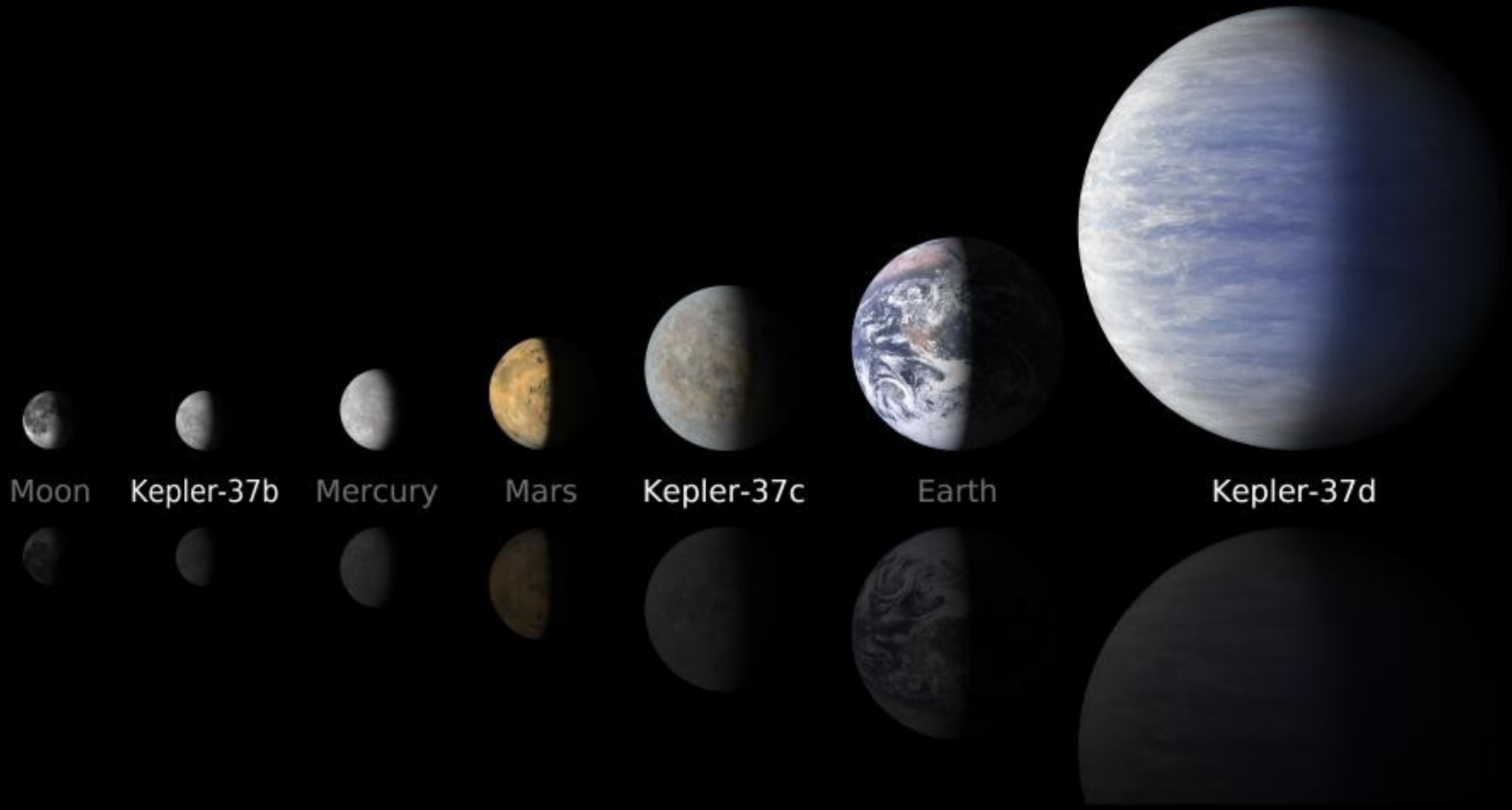




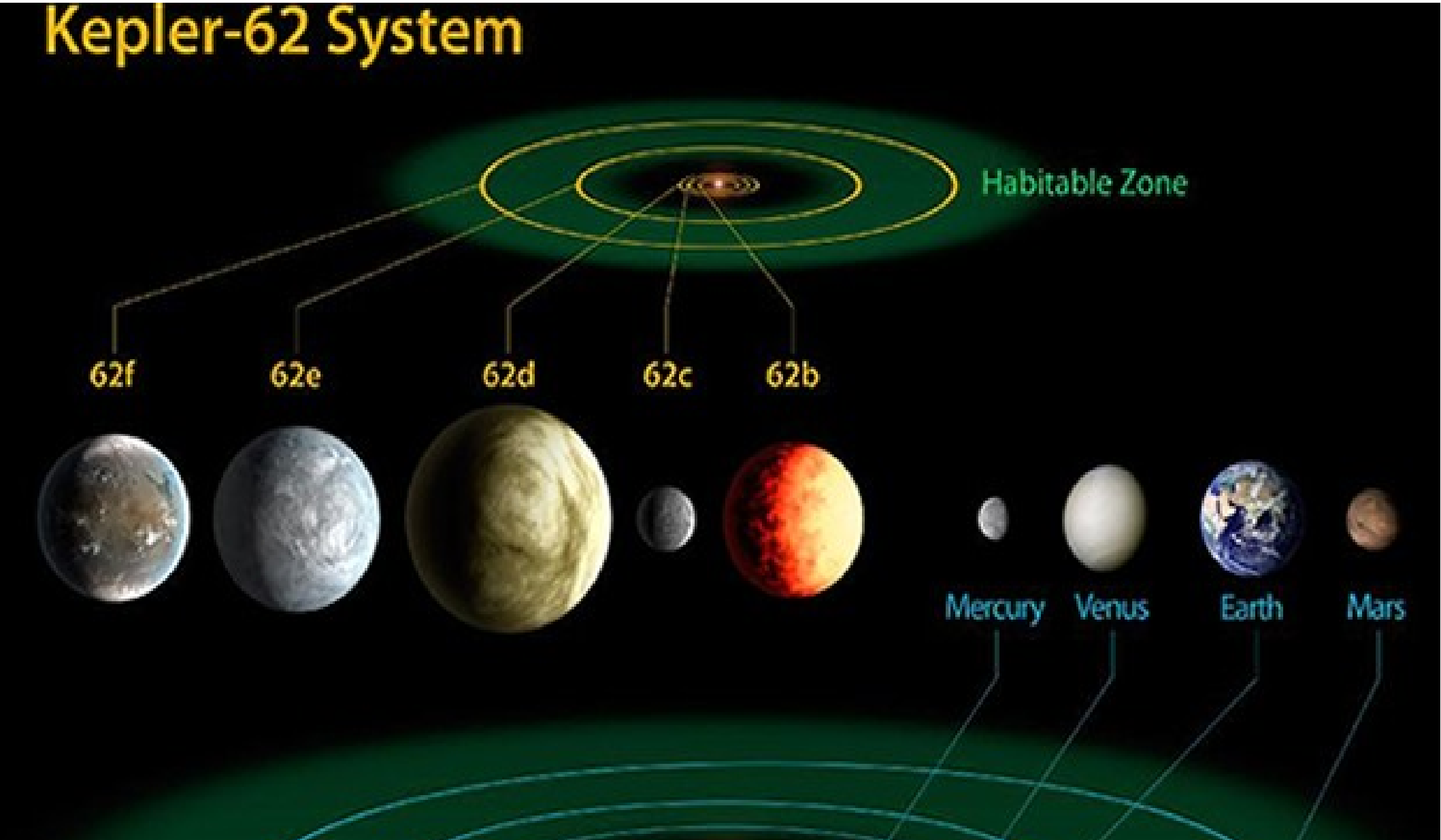


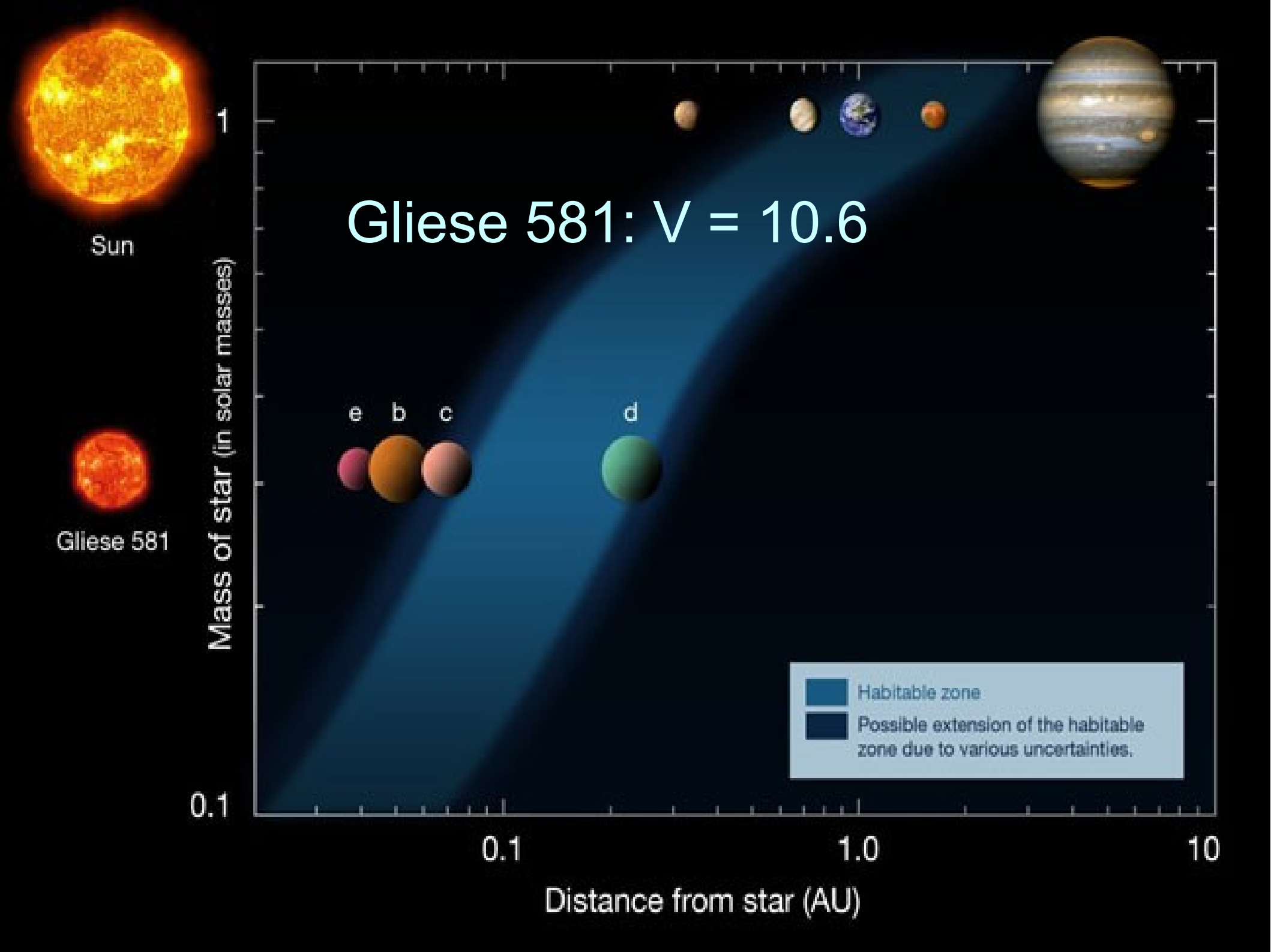

HD97658 b
GJ1214 b
Kepler-11 f
Kepler-18 b
55Cnc e
Kepler-11 b
Kepler-20 b
CoRoT-7 b
Kepler-10 b
Earth
Kepler-20 f
Venus
Kepler-20 e
Mars
R_p ($R_\oplus$)
M_p ($M_\oplus$)
0
2
4
6
8
10
0.5
1
1.5
2
2.5
3

Kepler 37: V= 9.8; some small planets



Kepler 62: V = 13.8; P_{orb} = 5.7, 12.4, 18.2 days




Sun
Gliese 581
Gliese 581: V = 10.6
e
b
c
d
Habitable zone
Possible extension of the habitable zone due to various uncertainties.
Mass of star (in solar masses)
1
0.1
0.1
1.0
10
Distance from star (AU)

The Plan(?)

* Keep observing at Baker Obs
* Apply for KPNO 2.1m time for next semester (spring 2014)
* In March, apply for KPNO time for Kepler targets for Fall 2013
* In March, apply for IR time based on lab results?
* Create model to predict planet's contribution: Amanda or GA?
* Use multiple methods for reducing/analyzing data to increase precision.