Worksheet

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SuperEarths - searching life beyond Solar System

Topic: Searching life beyond Solar System

Students' age: 15-19

Time: 2 lessons

Exoplanets in ecospheres

1. Fill in the table using data on exoplanets available on the site http://exoplanets.org/table In the last column write in YES or NO depending on whether given exoplanet is or is not in a star's habitable zone. Symbols: a – average distance between the exoplanet and its star (its semi-major axis), T_eff^* - effective temperature of the star, R_* - radius of the star.

Nr	Name of exoplanet	a [au]	T^*_{eff}[K]	R_*	r_{min}	r_{max}	Is it in the habitable zone?
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

The minimal distance between a habitable zone and a star can be calculated using following formula:

$$r_{min} = r_0 \frac{R_*}{R_\odot} \left(\frac{T^*_{eff}}{T^\odot_{eff}} \right)^2$$

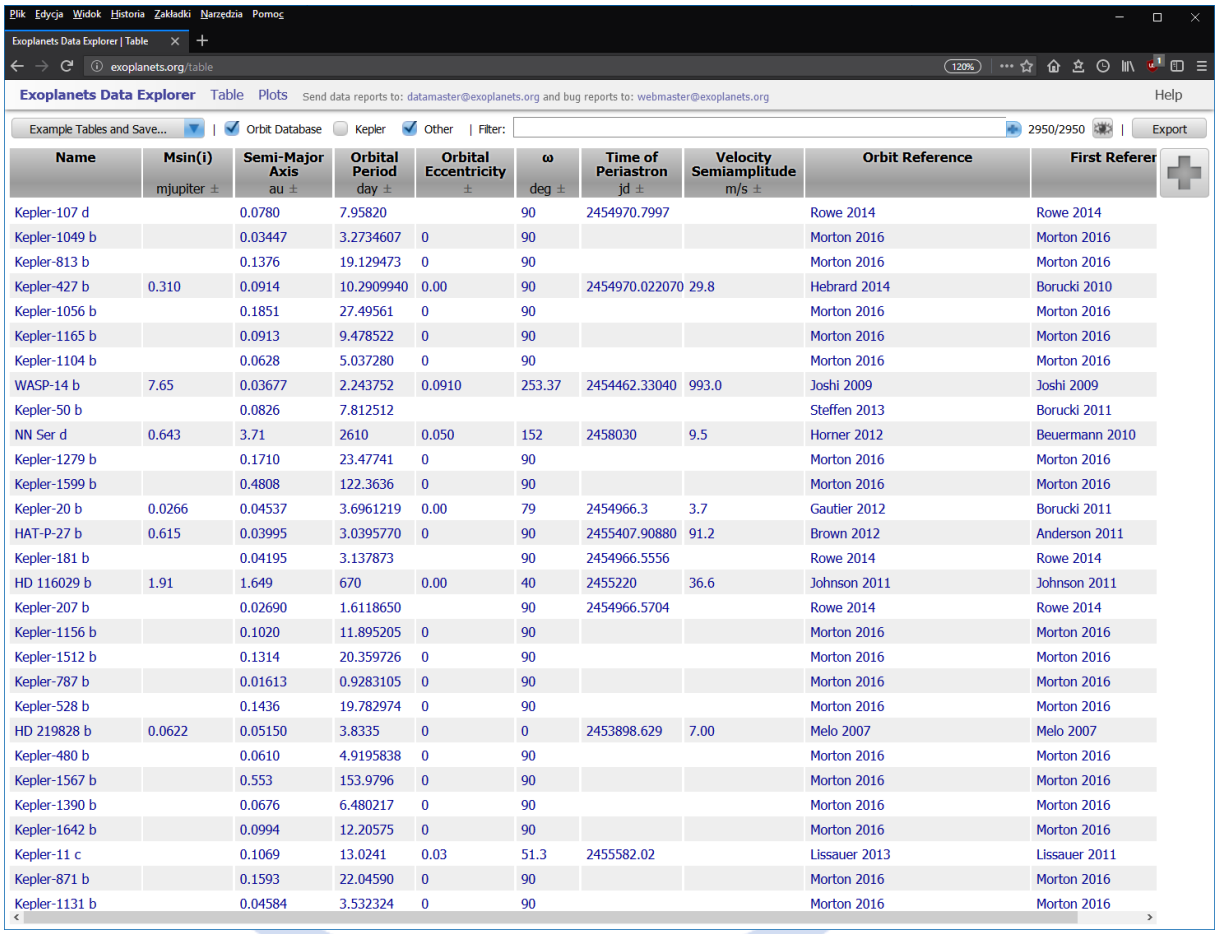
The maximal distance between a habitable zone and a star can be calculated using following formula:

$$r_{max} = r_1 \frac{R_*}{R_\odot} \left(\frac{T^*_{eff}}{T^\odot_{eff}} \right)^2$$

where $r_0 = 0.72$ au, $r_1 = 1.53$ au, $T^\odot_{eff} = 5772$ K – effective temperature of the Sun, $R_\odot$ - radius of the Sun. Assume, that the exoplanet is in the habitable zone if $r_{min} \leq a \leq r_{max}$.

Exoplanet catalogue

Link to the catalogue: http://exoplanets.org/table. After clicking on the preceding link the following view appears, where an exoplanet's name is given in the first column. By clicking on the "**Name**" button we can sort the exoplanets by their names. The "**Filter**" field allows us to filter exoplanets by their names.

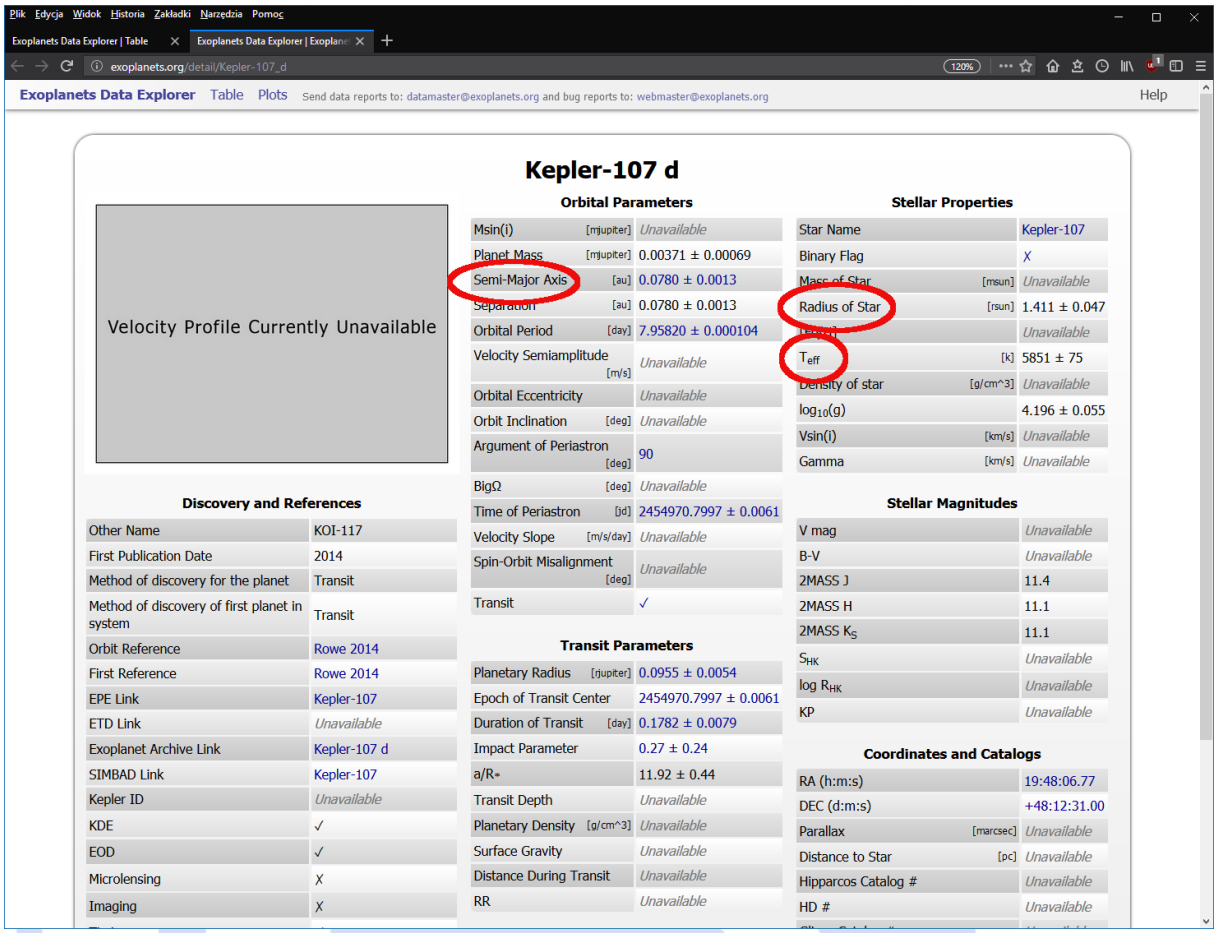


Name	Msin(i) mjupiter ±	Semi-Major Axis au ±	Orbital Period day ±	Orbital Eccentricity ±	ω deg ±	Time of Periastron jd ±	Velocity Semiamplitude m/s ±	Orbit Reference	First Referer
Kepler-107 d		0.0780	7.95820		90	2454970.7997		Rowe 2014	Rowe 2014
Kepler-1049 b		0.03447	3.2734607	0	90			Morton 2016	Morton 2016
Kepler-813 b		0.1376	19.129473	0	90			Morton 2016	Morton 2016
Kepler-427 b	0.310	0.0914	10.2909940	0.00	90	2454970.022070	29.8	Hebrard 2014	Borucki 2010
Kepler-1056 b		0.1851	27.49561	0	90			Morton 2016	Morton 2016
Kepler-1165 b		0.0913	9.478522	0	90			Morton 2016	Morton 2016
Kepler-1104 b		0.0628	5.037280	0	90			Morton 2016	Morton 2016
WASP-14 b	7.65	0.03677	2.243752	0.0910	253.37	2454462.33040	993.0	Joshi 2009	Joshi 2009
Kepler-50 b		0.0826	7.812512					Steffen 2013	Borucki 2011
NN Ser d	0.643	3.71	2610	0.050	152	2458030	9.5	Horner 2012	Beuermann 2010
Kepler-1279 b		0.1710	23.47741	0	90			Morton 2016	Morton 2016
Kepler-1599 b		0.4808	122.3636	0	90			Morton 2016	Morton 2016
Kepler-20 b	0.0266	0.04537	3.6961219	0.00	79	2454966.3	3.7	Gautier 2012	Borucki 2011
HAT-P-27 b	0.615	0.03995	3.0395770	0	90	2455407.90880	91.2	Brown 2012	Anderson 2011
Kepler-181 b		0.04195	3.137873		90	2454966.5556		Rowe 2014	Rowe 2014
HD 116029 b	1.91	1.649	670	0.00	40	2455220	36.6	Johnson 2011	Johnson 2011
Kepler-207 b		0.02690	1.6118650		90	2454966.5704		Rowe 2014	Rowe 2014
Kepler-1156 b		0.1020	11.895205	0	90			Morton 2016	Morton 2016
Kepler-1512 b		0.1314	20.359726	0	90			Morton 2016	Morton 2016
Kepler-787 b		0.01613	0.9283105	0	90			Morton 2016	Morton 2016
Kepler-528 b		0.1436	19.782974	0	90			Morton 2016	Morton 2016
HD 219828 b	0.0622	0.05150	3.8335	0	0	2453898.629	7.00	Melo 2007	Melo 2007
Kepler-480 b		0.0610	4.9195838	0	90			Morton 2016	Morton 2016
Kepler-1567 b		0.553	153.9796	0	90			Morton 2016	Morton 2016
Kepler-1390 b		0.0676	6.480217	0	90			Morton 2016	Morton 2016
Kepler-1642 b		0.0994	12.20575	0	90			Morton 2016	Morton 2016
Kepler-11 c		0.1069	13.0241	0.03	51.3	2455582.02		Lissauer 2013	Lissauer 2011
Kepler-871 b		0.1593	22.04590	0	90			Morton 2016	Morton 2016
Kepler-1131 b		0.04584	3.532324	0	90			Morton 2016	Morton 2016

By clicking on an exoplanet's name (left column) we get to see the following view, where red ellipses mark placements of parameters needed to determine the size of a habitable zone and whether or not the planet is inside it. Red ellipses mark correspondingly:

- Exoplanet's semi-major axis expressed in au[1].
- Radius of a star, R_*, expressed as a multiple of the Sun's radius.
- Star's effective temperature, T^*_{eff}, expressed in Kelvins.

[1] It is the average distance of an exoplanet from its star.


Plik Edycja Widok Historia Zakładki Narzędzia Pomoc
Exoplanets Data Explorer | Table
Exoplanets Data Explorer | Exoplanc
exoplanets.org/detail/Kepler-107_d
120%
Exoplanets Data Explorer Table Plots Send data reports to: datamaster@exoplanets.org and bug reports to: webmaster@exoplanets.org Help
Kepler-107 d
Velocity Profile Currently Unavailable
Orbital Parameters
Msin(i) [mjupiter] Unavailable
Planet Mass [mjupiter] 0.00371 ± 0.00069
Semi-Major Axis [au] 0.0780 ± 0.0013
Separation [au] 0.0780 ± 0.0013
Orbital Period [day] 7.95820 ± 0.000104
Velocity Semiamplitude [m/s] Unavailable
Orbital Eccentricity Unavailable
Orbit Inclination [deg] Unavailable
Argument of Periastron [deg] 90
BigΩ [deg] Unavailable
Time of Periastron [jd] 2454970.7997 ± 0.0061
Velocity Slope [m/s/day] Unavailable
Spin-Orbit Misalignment [deg] Unavailable
Transit ✓
Transit Parameters
Planetary Radius [rjupiter] 0.0955 ± 0.0054
Epoch of Transit Center 2454970.7997 ± 0.0061
Duration of Transit [day] 0.1782 ± 0.0079
Impact Parameter 0.27 ± 0.24
a/R* 11.92 ± 0.44
Transit Depth Unavailable
Planetary Density [g/cm^3] Unavailable
Surface Gravity Unavailable
Distance During Transit Unavailable
RR Unavailable
Stellar Properties
Star Name Kepler-107
Binary Flag X
Mass of Star [msun] Unavailable
Radius of Star [rsun] 1.411 ± 0.047
Unavailable
Teff [k] 5851 ± 75
Density of star [g/cm^3] Unavailable
log10(g) 4.196 ± 0.055
Vsin(i) [km/s] Unavailable
Gamma [km/s] Unavailable
Stellar Magnitudes
V mag Unavailable
B-V Unavailable
2MASS J 11.4
2MASS H 11.1
2MASS KS 11.1
SHK Unavailable
log RHK Unavailable
KP Unavailable
Coordinates and Catalogs
RA (h:m:s) 19:48:06.77
DEC (d:m:s) +48:12:31.00
Parallax [marcsec] Unavailable
Distance to Star [pc] Unavailable
Hipparcos Catalog # Unavailable
HD # Unavailable
Discovery and References
Other Name KOI-117
First Publication Date 2014
Method of discovery for the planet Transit
Method of discovery of first planet in system Transit
Orbit Reference Rowe 2014
First Reference Rowe 2014
EPE Link Kepler-107
ETD Link Unavailable
Exoplanet Archive Link Kepler-107 d
SIMBAD Link Kepler-107
Kepler ID Unavailable
KDE ✓
EOD ✓
Microlensing X
Imaging X

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