

# KELT-3b

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with respect KELT-b we get te following data:

Name	Median value	Lower error	Upper error	Case note	Target
Radius of the planet (in units of Earth radii)	16.82	0.16	0.16	Cheops observations	KELT-3b
Radius of the star (in units of Solar radii)	1.736	0.023	0.024	Cheops observations	KELT-3b
Mid-transit time (in units of days)	0.2764	0.0011	0.0011	Cheops observations	KELT-3b
Orbital period (in units of days)	2.70339			Other observations from the archive	KELT-3b
Orbital semi-major axis (in units of AU)	0.0464			Other observations from the archive	KELT-3b

Figure 1: principal data

## 1 Determination of the radius of the planet

We will use the following formula:

$$D\% = \frac{\pi R_p^2}{\pi R_s^2} * 100 \quad (1)$$

We need to find  $R_p^2$ , from the graphics we will obtain the deep of the transit:

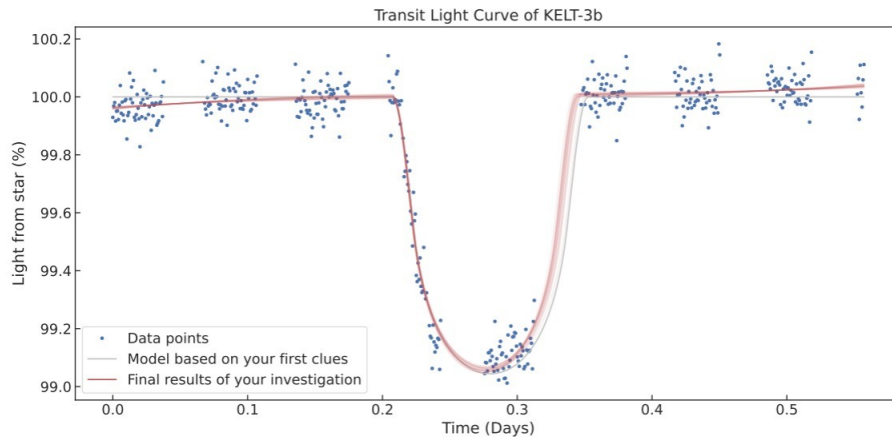


Figure 2: Curve obtained

we observe that the deep of the transit is  $D\% = 100\% - 99.1\% = 0.9\%$  so the expression for  $R_p$  is  $R_p = \sqrt{\frac{0.9}{100} R_s^2}$ , in the figure 1 we observe  $R_s = 1.736R_\odot$ , ( $R_\odot$  is the radius of the sun) so the radius of the planet is:

$$R_p = \sqrt{\frac{0.9}{100} (1.736R_\odot)^2} = 0.124R_\odot$$

## 2 Determination of the distance of the Planet to the Star

In this step we will use the third law of Kepler, that says :

$$T^2 = \frac{4\pi^2}{GM} d^3 \quad (2)$$

We know the period from the figure 1 ( $T = 2.70339$  dias) and also we know the mass of the star ( $M = 1.96M_\odot$ )

So we get the equation to the distance to the star:

$$d = \sqrt[3]{\frac{GMT^2}{4\pi^2}}$$

we calculate, considering  $M_\odot = 1.99 \times 10^{30}\text{kg.}$ ,  $1 \text{ day} = 24[h] * 3600[s]$ ,

$$d = \sqrt[3]{\frac{(6.673 \times 10^{-11})(1.96M_\odot)(2.70339d)^2}{4\pi^2}} = 1.869 \times 10^{10}[m] = 7.1117 \times 10^9[m] = 0.0475[ua]$$

where we consider  $1[ua] = 1.496 \times 10^{11}[m]$

## 3 Temperature

from the distance obtained, we can see that the planet are much close to his star, so the temperature in the planet must be really high, so the possibility of life can be discarded.

## 4 Density and Composition

In this step we will use two equations:

$$\rho = \frac{M_p}{V} \quad (3)$$

And

$$V = \frac{4}{3}\pi R_p^3 \quad (4)$$

combined this two equations we get:

$$\rho = \frac{3M_p}{4\pi R_p^3}$$

We know that the mass of the planet is:  $M_p = 617M_T$  where  $M_T = 5.98 \times 10^{27}[g]$  is the mass of the Earth, and also know the radius of the planet  $R_p = 16.82R_T$  where  $R_T = 6370 \times 10^5[cm]$ .making the calculations:

$$\rho = \frac{3(617(5.98 \times 10^{27} [g]))}{4\pi(16.82(6370 \times 10^5 [cm]))^3} = 0.716 \frac{g}{cm^3}$$

we can use the following table to know about the composition:

<b>Planeta</b>	<b>densidade média</b>
Mercúrio	5,44
Vênus	5,25
Terra	5,52
Marte	3,94
Júpiter	1,24
Saturno	0,63
Urano	1,21
Netuno	1,67
Plutão	1 (??)

Figure 3: mean densities of the planet of the solar system

so we observe that the density is approximately Saturn density, so is a Jupiterlike planet so is a gaseous planet probably composed Hydrogen, Helium, Metan and another gases.