Exploring Exoplanets with Kepler: WORKSHEET

Kepler's Third Law states:

The square of the orbital period of a planet is directly proportional to the cube of the semi-major axis of its orbit (or the average distance to the sun).

For our solar system and planets around stars with the same mass as our sun, that simply states that $R^3 = T^2$, where R is a planet's distance from the sun in Astronomical Units (AU) and T is the planet's orbital period in years.

Because the distance between Earth and the sun (1 AU) is 149,600,000 km and one Earth year is 365 days, the distance and orbital period of other planets can be calculated when only one variable is known.

1. **Use Kepler's Third Law to calculate the missing data for these planets in our solar system.**

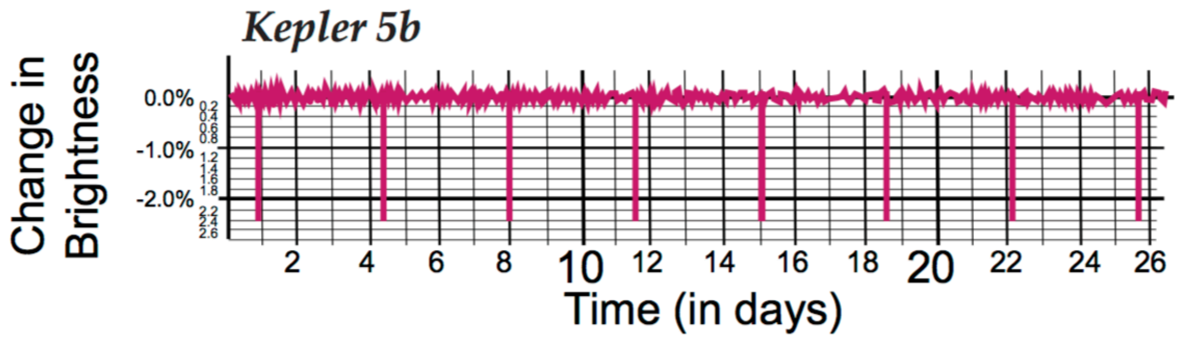
Planet	Orbital Period (years)	Orbital Period (days)	Distance from Sun (AU)	Distance from Sun (km)
Mercury			0.387 AU	
Venus		224.7 days		
Earth	1 year		1 AU	

For planets around other stars (exoplanets), we must modify the formula to account for the variation in the star's mass as compared with our sun. So we use $R = \sqrt[3]{T^2 \cdot M_s}$ where M_s = is the star's mass in relation to our sun's mass.

2. **Use Kepler's Third Law and the light curve data below to calculate the missing data for Kepler-5b, 6b, 7b and 8b. Then, calculate the missing information for Kepler-452b, the most Earth-like exoplanet yet discovered.**

Planet	Mass of Parent Star (relative to sun)	Orbital Period (days)	Distance from Parent Star (AU)	Distance from Parent Star (km)
Kepler-5b			0.05064 AU	
Kepler-6b	1.21 M_s			
Kepler-7b				9,350,000 km
Kepler-8b	1.21 M_s			
Kepler-452b	1.04 M_s			156,500,000 km

FUN FACT: Stars observed by the Kepler mission with confirmed exoplanets are named Kepler-1, Kepler-2, Kepler-3, etc. The exoplanets around these stars are given a letter that corresponds to the order in which they were discovered, starting with *b.* So, Kepler-5b is the first exoplanet discovered around the fifth star found to have a planet.


Kepler 5b
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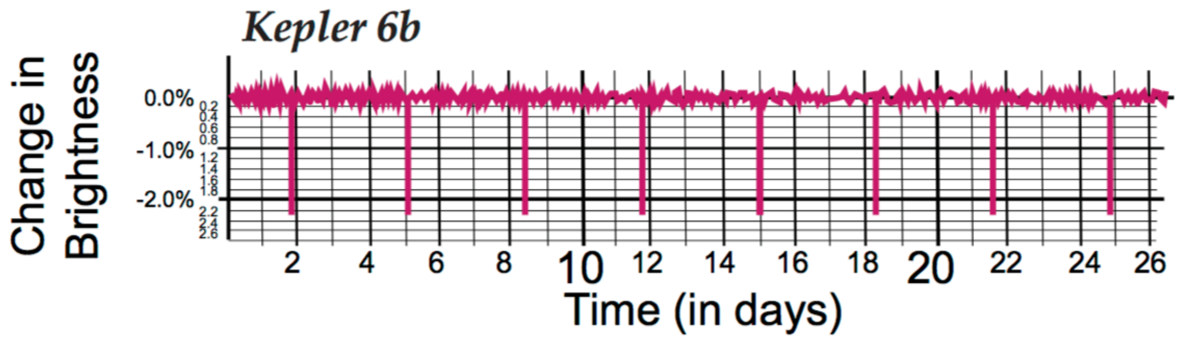
Time (in days)


Kepler 6b
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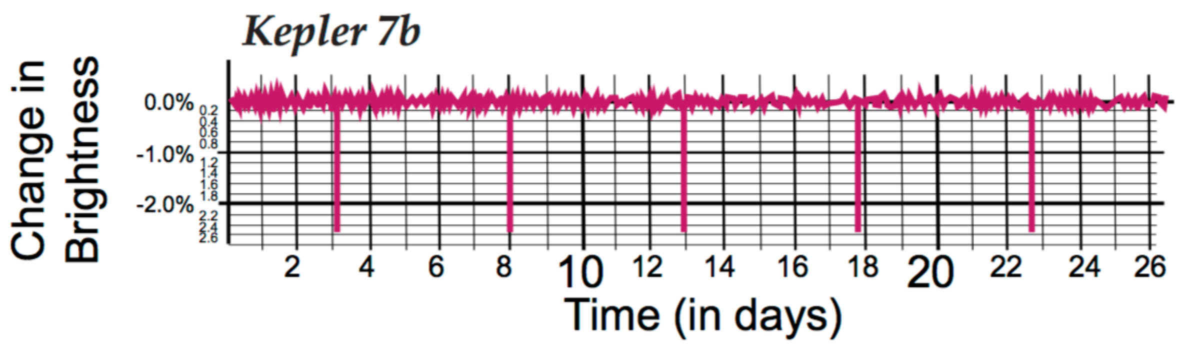
Kepler 7b
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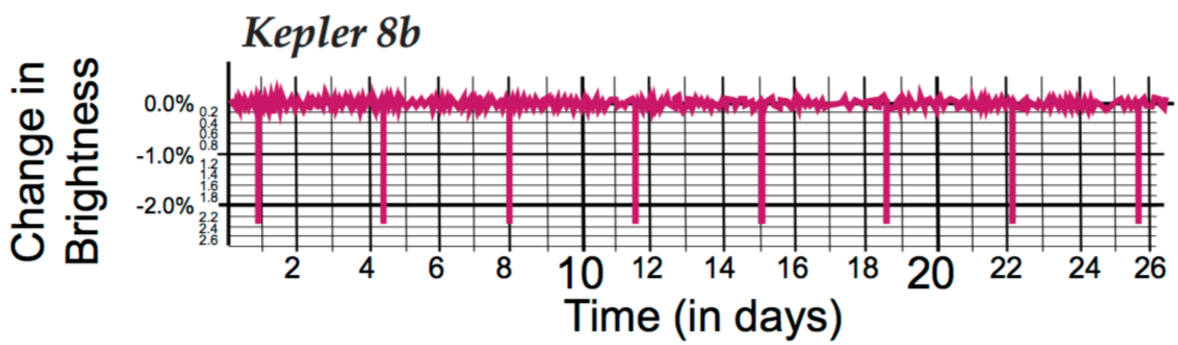
Kepler 8b
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