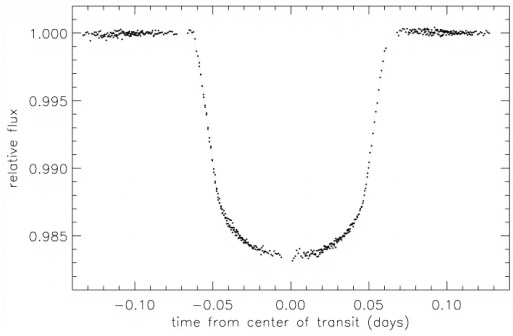
Exoplanet Transits

One of the ways that we search for exoplanets is by looking for times when these planets pass in front of their host star, dimming its light. We call this the **transit method**.

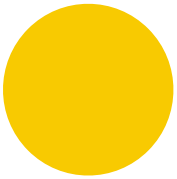
In this activity we're going to explore the transit method, and by the end we'll be using the data below to calculate the actual size of an exoplanet! But don't worry about that yet.

Exoplanet Transit Data:

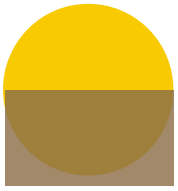


When a planet passes in front of a star, it blocks part of the star's light, meaning that we see less light here at Earth. Below are examples of stars with some fraction of their light blocked by strange shapes.

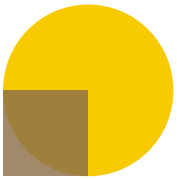
1.) For each example, label the fraction of the star's light that is blocked.



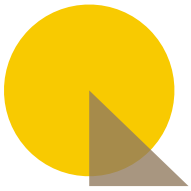
Fraction of light blocked: **0**



Fraction of light blocked: **1/2**

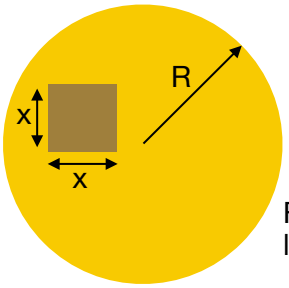


Fraction of light blocked: _____

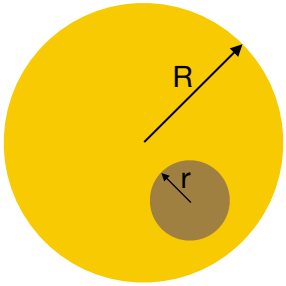


Fraction of light blocked: _____

Sometimes we can't get an exact number, and instead make a formula. Try these:

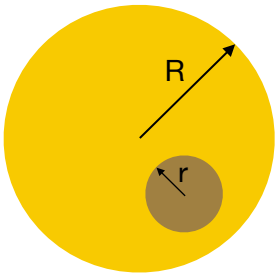


Fraction of light blocked: _____



Fraction of light blocked: _____

The last example on the previous page is a good representation of a planet moving in front of a star.



Let's say the star has radius **R** = 700,000 km (the radius of our sun).

2.) Using your previous answer, what fraction of light would be blocked by a planet of radius **r** = 70,000 km? (roughly the radius of Jupiter)

3.) How much light would be blocked by a planet of radius **r** = 25,000 km? (roughly the radius of Uranus)

4.) How much light would be blocked by a planet of radius **r** = 7,000 km? (roughly the radius of Earth)

Now let's try working in the other direction.
If we know how much light is blocked, we can figure out the size of the planet.

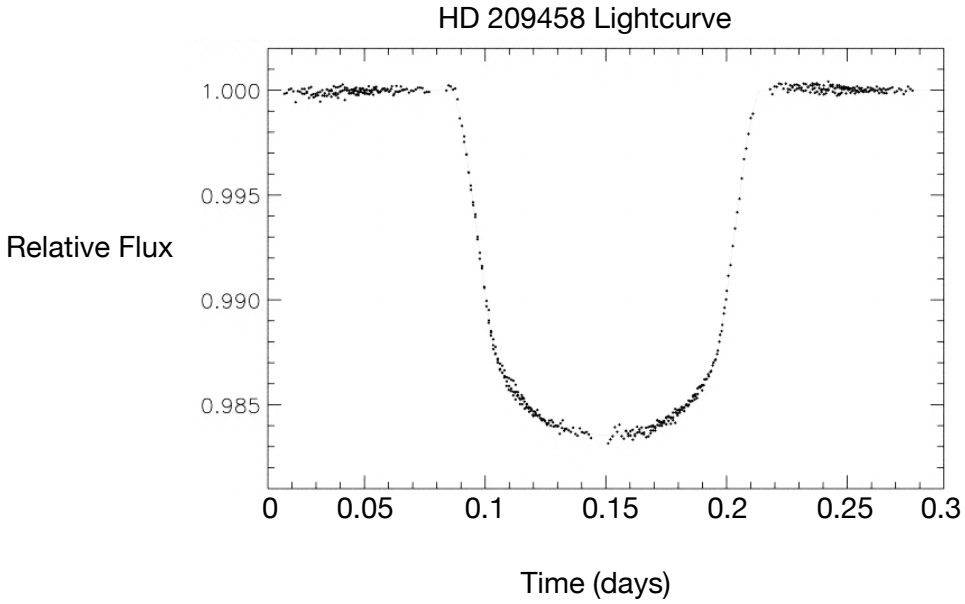
Using the same star of radius **R** = 700,000 km…

5 a.) If 5% of the star's light is blocked by a planet, what is the radius of that planet?

b.) Would this be a big planet? Compare it to the sizes of Earth and Jupiter.

Now let's use some data!

Below is a plot of a "lightcurve" for the star HD 209458. This tells us the amount of light that we are receiving from the star over time.



The **x-axis** of this plot shows us **time** elapsed.

The **y-axis** shows us the **amount of light** we are receiving from the star. It is in units of "relative flux", where a value of 1.00 means that we are receiving 100% of the usual light from the star.

In the center of the plot we can see a period of time when the light from the star decreases, meaning it is being blocked by a planet!

We know that HD 209458 has a radius of 84,000 km (1.2 times larger than our sun)

6.) Using the information on the previous page, calculate the radius of the planet that is blocking the light from HD 209458.

7.) Is this a big planet? How does it compare to the sizes of Earth and Jupiter?

8.) Do you think this method of finding exoplanets would be better at finding large planets or small planets? Why?

9.) What features other than radius might we be able to determine using this method? How would we determine those features?