The Exoplanet Transit Method

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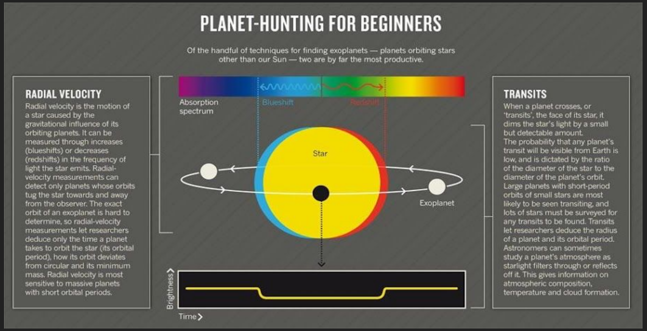
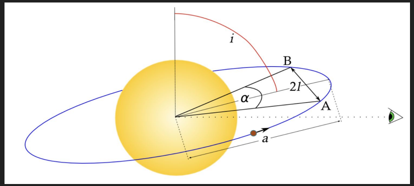
The Components

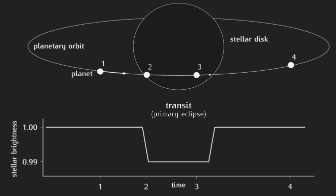
1. The Graph
2. Horizontal Translation
3. Circular Orbit

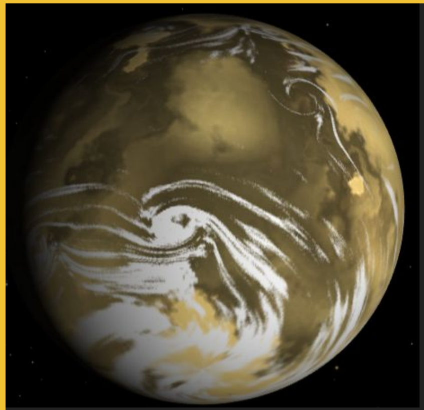
The Graph

Understanding an Exoplanet Transit









Kepler-186 f

PLANET TYPE Super Earth	DISCOVERY DATE 2014
MASS 1.71 Earths	PLANET RADIUS 1.17 x Earth
ORBITAL RADIUS 0.432 AU	ORBITAL PERIOD 129.9 days
ECCENTRICITY 0.04	DETECTION METHOD Transit

R(star) = .47*sun = 327283115.85 m = 3.2728 * 10^8 m

R(planet) = 1.17*Earth = 7454153.1051 m = 7.4542 * 10^6 m

R(orbit) = .432 AU = 6.46263 * 10^10 m

Orbital period: 129.9 days = 3117.6 hr

Mass(star) = 0.48*Mass(sun) = 9.5472 x 10^29 kg

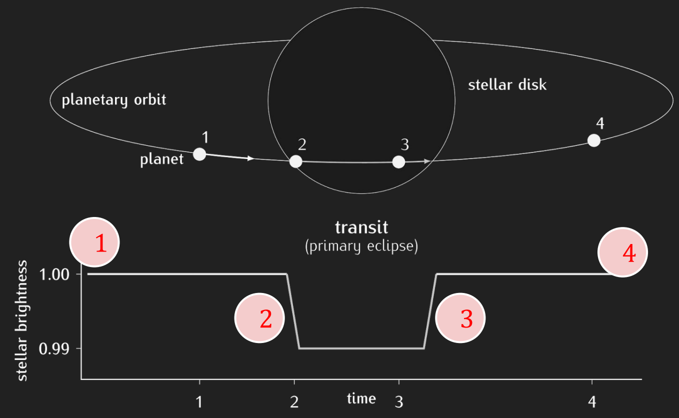
Mass(planet) = 1.44*Mass (earth) = 8.59968 x 10^24 kg

Planet to star radius ratio = .021

Velocity = C/T = .432AU * 2 * pi / 129.9 = 3125935478000 m/days = 3.1259 * 10^12 m/days = 1.3024 * 10/11 m/hr

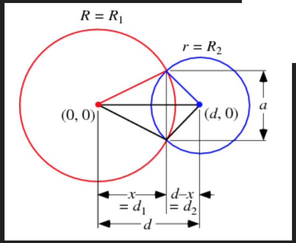
The Graph

Components of the Code



2 3

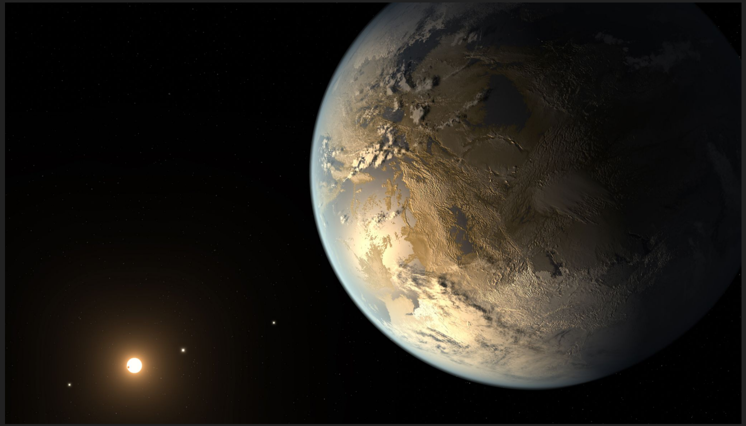
$$= r^2 \cos^{-1}\left(\frac{d^2 + r^2 - R^2}{2\,d\,r}\right) + R^2 \cos^{-1}\left(\frac{d^2 + R^2 - r^2}{2\,d\,R}\right) - \frac{1}{2}\sqrt{(-d + r + R)(d + r - R)(d - r + R)(d + r + R)}\,.$$



Final Step: Animate!

Why Kepler-186f?

- The first validated Earth-size planet to orbit a distant star in the habitable zone (a distance where liquid water might pool on the planet's surface)
- A planet the size of Kepler-186f is likely to be rocky
- Kepler-186f is near the outer edge of the habitable zone, orbiting its star once every 130 days and receiving one-third the energy that Earth does from the sun.
- If you could stand on the surface of Kepler-186f, the brightness of its star at high noon would appear as bright as our sun is about an hour before sunset on Earth.
- The Kepler-186 system, home to four inner planets, is about 500 light-years from Earth in the constellation Cygnus



Horizontal Translation

Goal: animate the exoplanet’s linear transit across the sun

- Plotted subplots, created an empty array to hold positions of the planet
- Used ax.scatter to plot the sun as a dot at the center of the graph
- Used np.append to plot the moving exoplanet as a series of dots moving horizontally across the screen, passing through the center of the sun

Circular Orbit

Exoplanet transit equations assume circular orbit

(Insert information about circular orbit once working)

Sources

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