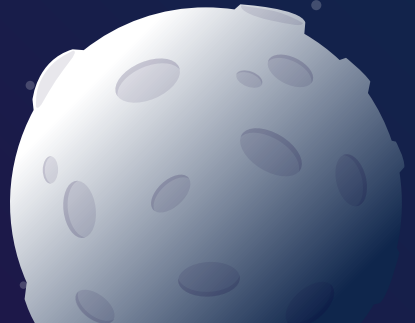
Calculating the Transit of GJ436b



GJ436b

- A hot Neptune
  - First Neptune sized planet discovered
- Orbits M-Dwarf star
- Detected by Spitzer Space Telescope

Motivation

Calculate GJ436b radius and transit period as the planet passes in front of its star in our view

How do we calculate these numbers?

First

- Upload all the data points form the research paper to code
- Read file

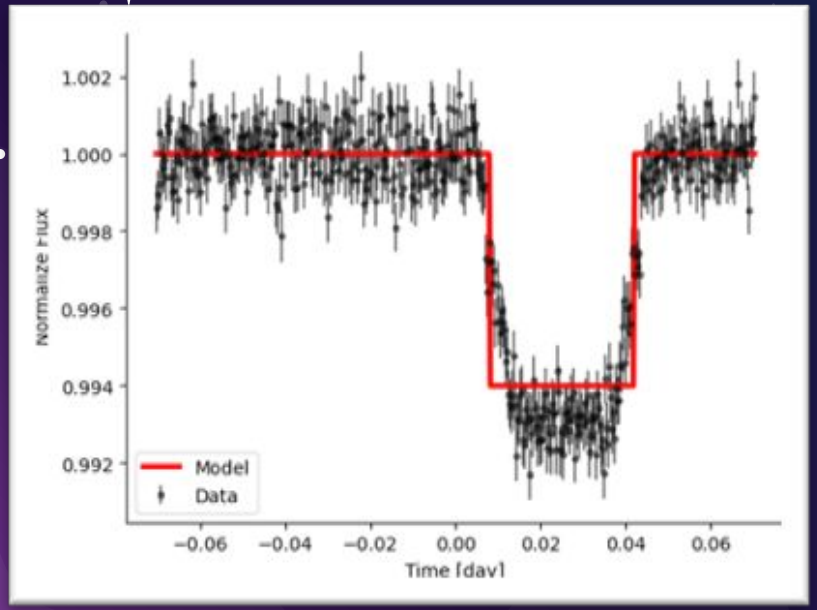
Second

- Plot data points, taking into consideration of error in flux readings
- Y axis is the normalization flux
- X axis is the time in days

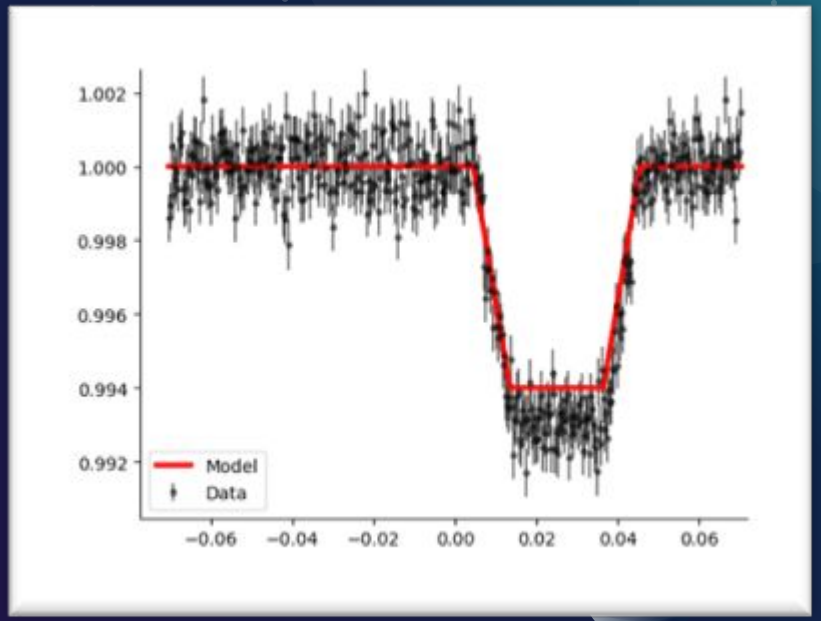
Third

- Add a box and trapezoidal model on plot
- This will help approximate the center time, duration, depth, and delta flux
- Calculate chi-squared to test accuracy to original plot

Results



Box Model



Trapezoidal Model

What does this tell us?

From the number we approximated to get the two different models, we use the the delta flux and the stars radius from Deming et al. to calculate the radius.

2.598

Chi-squared for box

1.109

Chi-squared for trapezoid

27,160.92 km

Radius

Conclusion

Upon further research on the planet I learned :

The planet takes only 2.6 days to orbit its star

What does that mean for the planet?

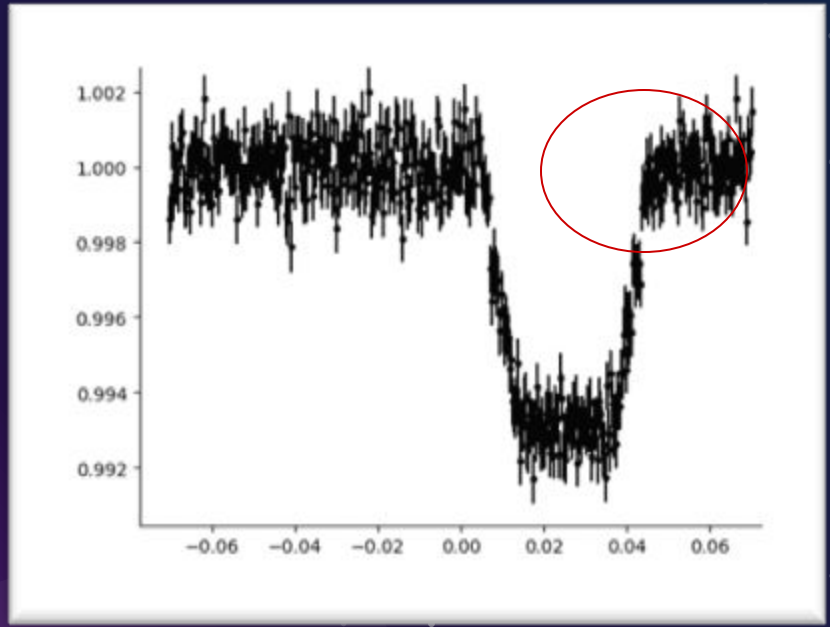
Due to its proximity, the GJ436b temperatures are really high. (712K)

What effect does this have on the planet?

Conclusion cont.

Due to the heat, the hydrogen on the planet boils away, leaving a trail of hydrogen gas in its path around its star

This is evident in the original plot
This graph has a slight curve to it
when the transit is coming to an end



Citations

Deming, D., Harrington, J., Laughlin, G., Seager, S., Navarro, S. B., Bowman, W. C., & Horning, K. (2007). Spitzer Transit and Secondary Eclipse Photometry of GJ 436b. In The Astrophysical Journal (Vol. 667, Issue 2, pp. L199–L202). American Astronomical Society. https://doi.org/10.1086/522496

“ESA Science & Technology - Hubble Sees Atmosphere Being Stripped from Neptune-Sized Exoplanet [Heic1515].” *Sci.esa.int*, 24 June 2015, sci.esa.int/web/hubble/-/56089-hubble-sees-atmosphere-being-stripped-from-neptune-sized-exoplanet-heic1515. Accessed 7 Dec. 2023.