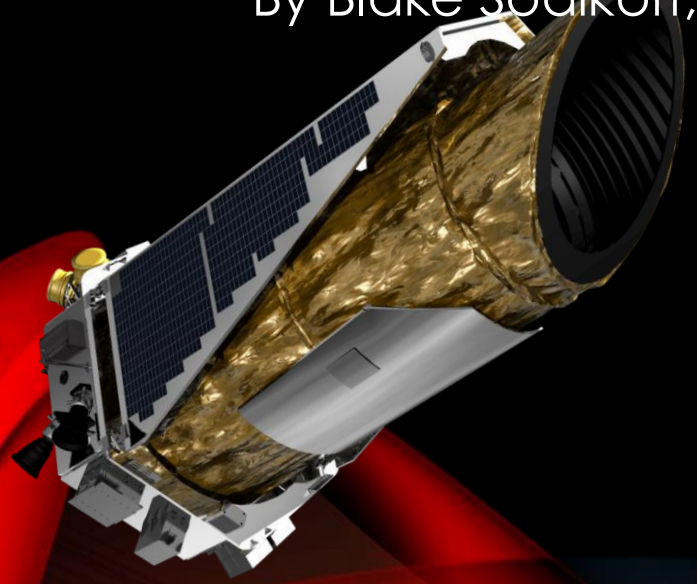
Project 2: Measuring mass, radius, and density

By Blake Sodikoff, Ian Luckeydoo, Angelo O'Dorisio



Who are we?

Ian Luckeydoo

Angelo O'Dorisio

Blake Sodikoff

MOTIVATION

By engaging with these problems head on we gain valuable insight into handling real world problems involving scientific measurements

Improving our understanding of exoplanet detection

Wasp-12b

Engaging with key comcepts of exoplanetary science

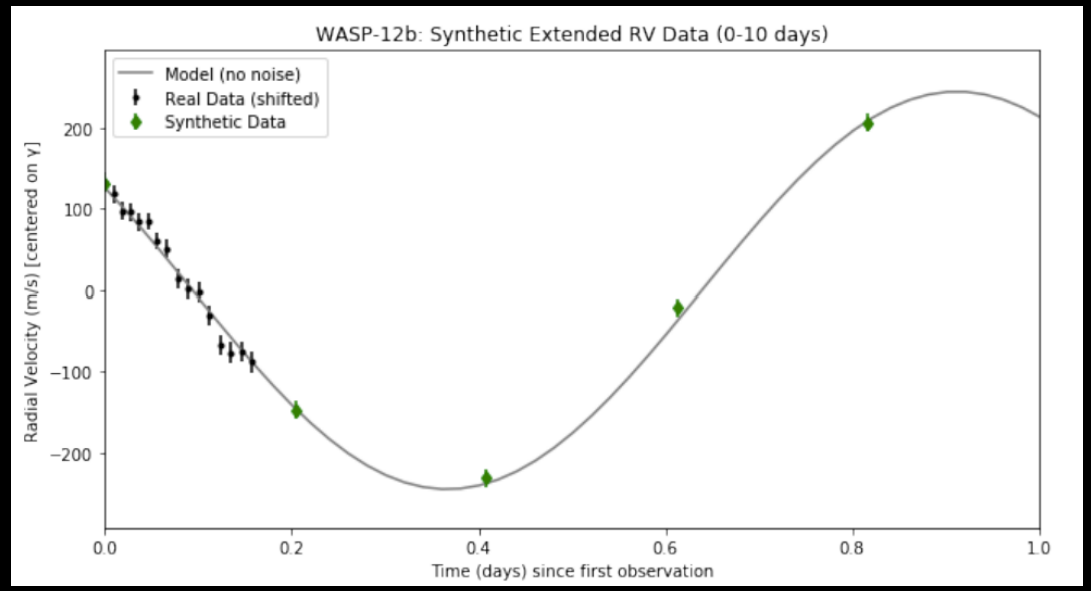
Understanding the bias of data recieved

Understanding more of the measurements of an exoplanet

Data acquisition, Measurement techniques, roles of uncertainty in calculating our measurments

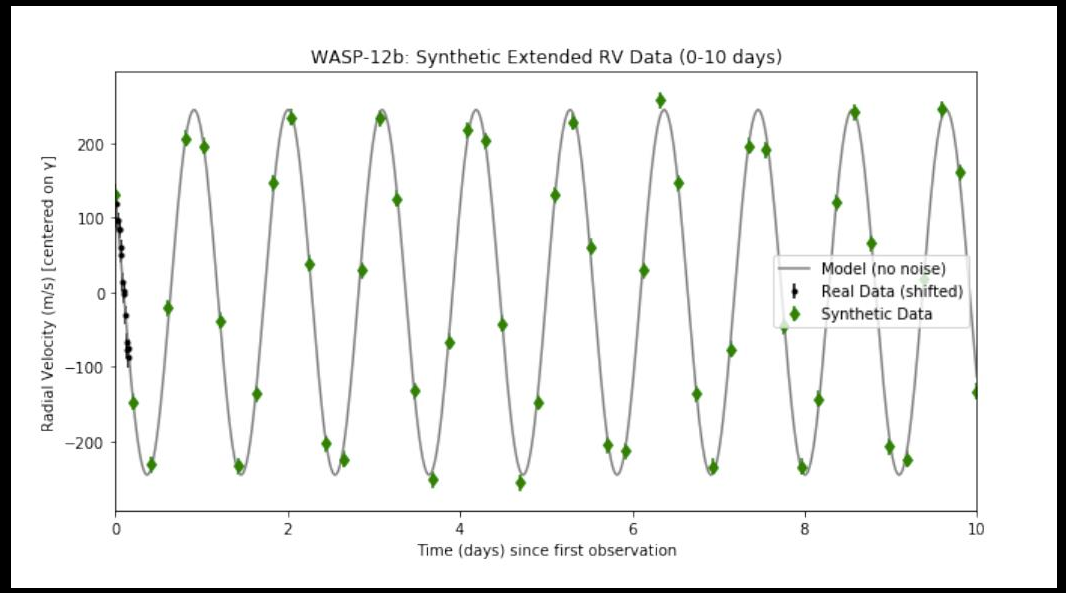
METHODOLOGY

Retrieving Exoplanet data from NEA and loading, cleaning, formatting it into Python (*Wasp 12-b*)



Please note: This was 1 day after observation

The data for WASP-12b was clustered close to observation time So using a model discussed in class, synthetic data points were created to simulate points within the bounds of uncertainty



METHODOLOGY CONT.

$$K = \left(\frac{2\pi G}{P}\right)^{\frac{1}{3}} \frac{M_p \sin i}{M_\star^{\frac{2}{3}}}$$

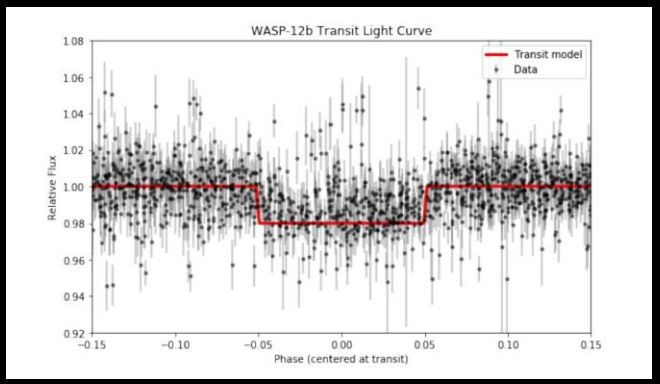
Finding the semi amplitude

$$M_p = K \cdot M_\star^{\frac{2}{3}} \cdot \left(\frac{P}{2\pi G}\right)^{\frac{1}{3}} \cdot \frac{1}{\sin i}$$

To then find the Mass

$$\delta = \frac{R_p^2}{R_\star^2}$$

Radius equation



THE OHIO STATE UNIVERSITY

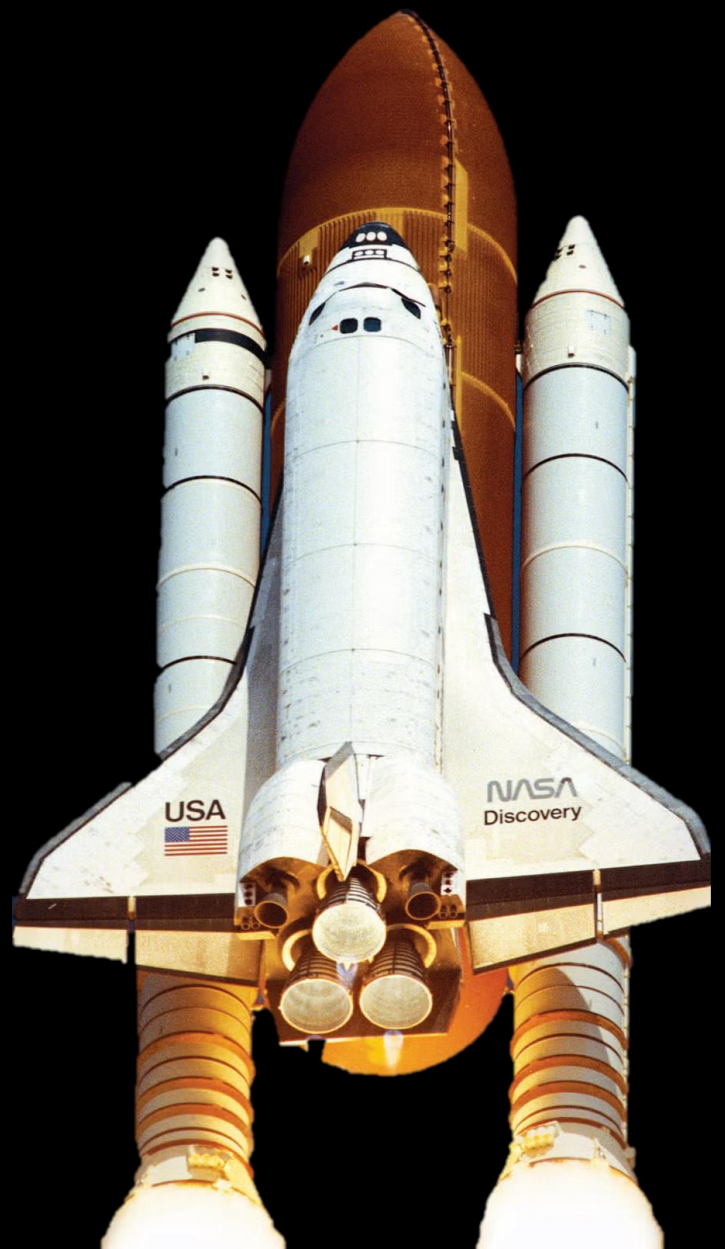
DEPARTMENT OF ASTRONOMY

RESULTS

Mass of Wasp 12-b: $2.88*10^{27}$kg (±0.05kg) or 1.52 Jupiter mass (±0.04)

Radius of Wasp 12-b: $1.34*10^{6}$ m (±0.06) or 1.88 Jupiter radius (±0.09)

Density of Wasp 12-b: 28.58 kg/m^3 (±41.38)



Blake Sodikoff reposted

Kendrick Lamar ✓
@kendricklamar

Man these guys are super smart, I now understand how radial velocity can be used to calculate mass, radius, and density, thanks guys!

12:21 PM · Feb 20, 2025

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CONCLUSION

In this project, we dealt with the inherent challenges such as observational bias and limitations of current methods, we were reinforced in the principle of precision by use of uncertainty analysis. Future studies could be improved by way of additional observational methods, more advanced statistical methods, and refining models.

This project demonstrated the effectiveness of transit and radial velocity techniques in exoplanetary science. Continued advancements will further refine the classification of these distant worlds and improve our ability to study them

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# maybe WASP 12 b wasn't the easiest choice
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