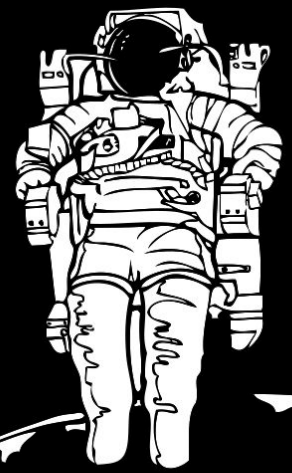
ANALYZING ORBITAL PROPERTIES OF KOI SYSTEMS

Kaitlyn Le



GOALS

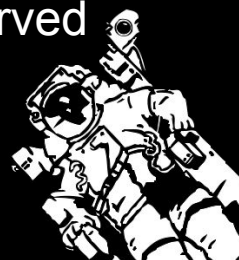
Model the given data in the NASA Planetary Composite Database

Create best-fit lines to find if there are correlations between two orbital properties

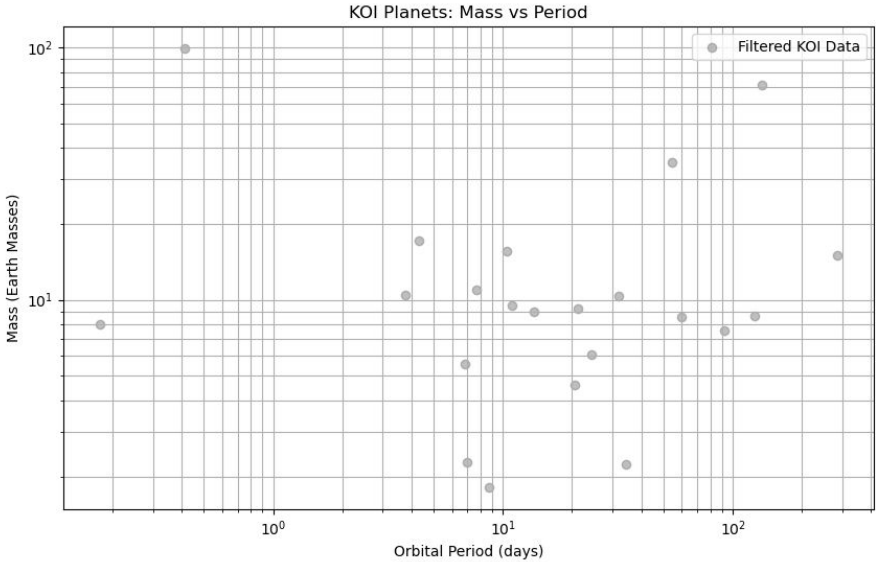
Find residuals of the best-fit lines

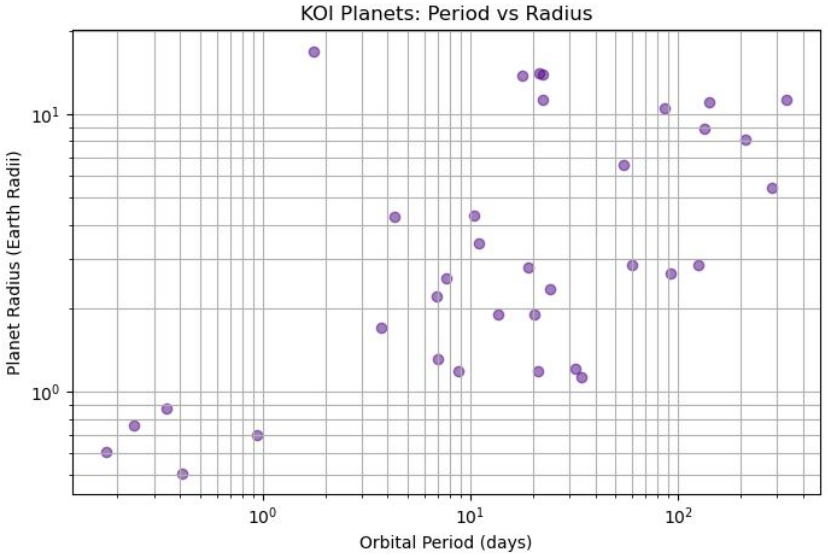
METHODOLOGY

- Data used: NASA Planetary Composite Data (filtered to only take KOI system data; masses are constrained to 1-100 Earth Masses, planets with positive radii and periods were utilized)
- Power Law for Best Fit: y = CP*k
  - assists in expressing empirical relationship between two variables
- For residuals: $\frac{1}{n}\sum(y_{\text{observed}} - y_{\text{expected}})^2$
  - the predicted values are from the best-fit line while the observed values are from the data

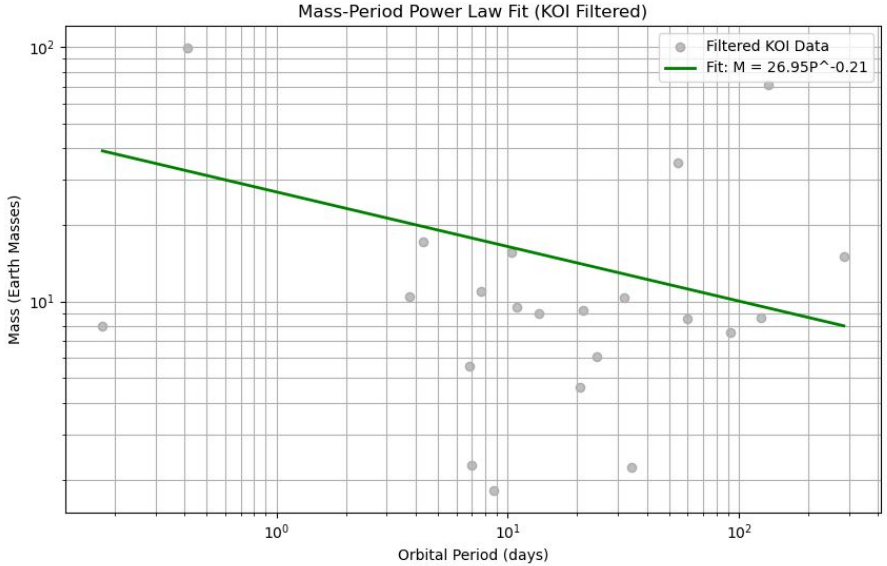


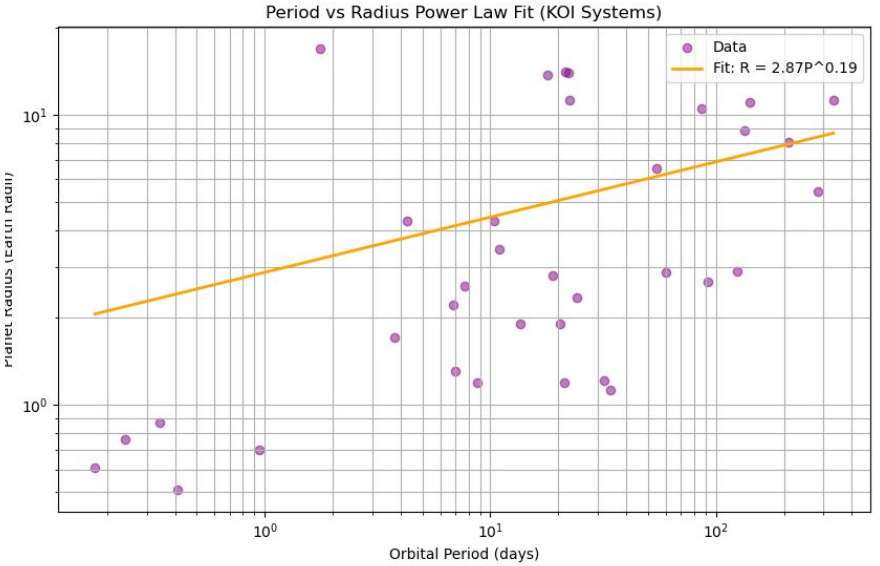
MODELLING THE DATA



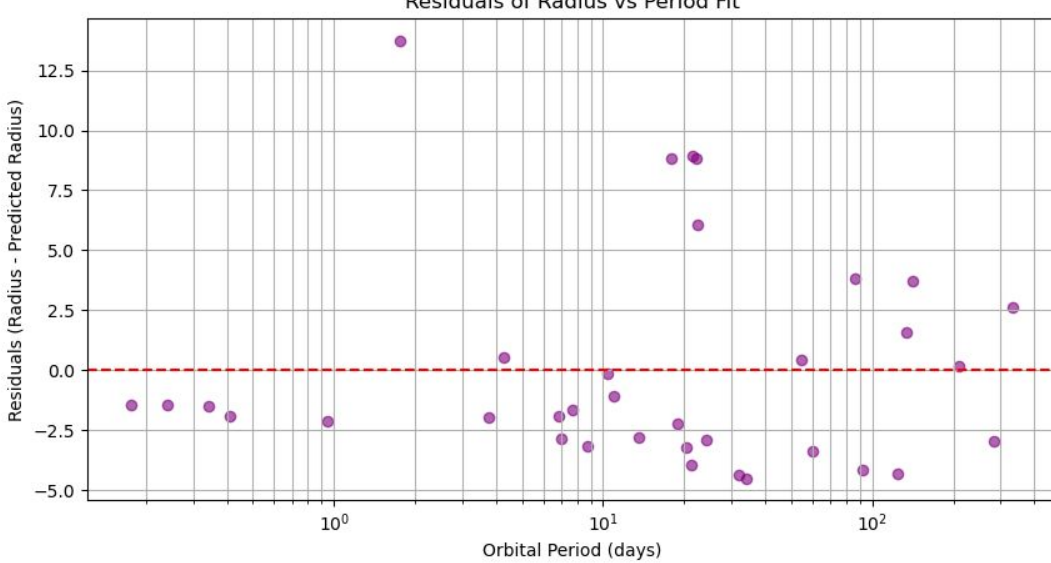


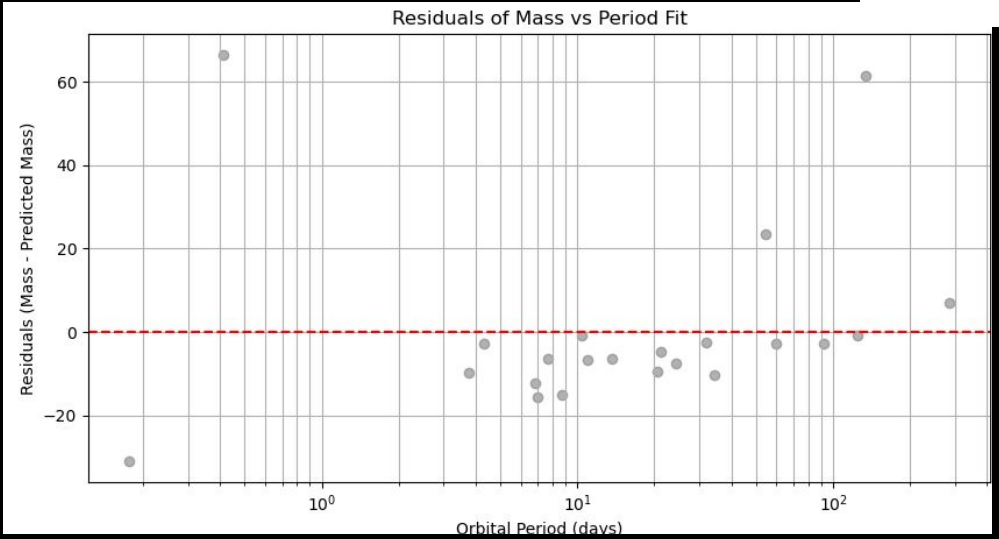
BEST FIT LINES





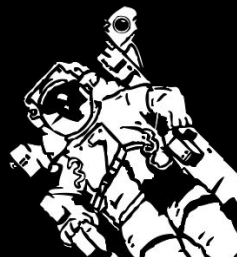
RESIDUALS


Residuals of Radius vs Period Fit
Residuals (Radius - Predicted Radius)
12.5
10.0
7.5
5.0
2.5
0.0
−2.5
−5.0
10^0
10^1
10^2
Orbital Period (days)


Residuals of Mass vs Period Fit
Residuals (Mass - Predicted Mass)
60
40
20
0
−20
10^0
10^1
10^2
Orbital Period (days)

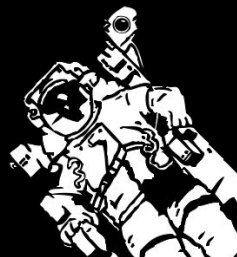
RESULTS

- For mass-period relationship, I initially had a flat line as my best fit line because I did not properly filter the dataset. After filtering, there was a trend that emerged between mass and period where it seemed to be an inverse relationship. The trend showed that as period increased, the planetary mass would decrease.
- For radius–period relationship, there was a weak but positive correlation. Larger planets tended to have longer periods and that the best-fit line parameters suggested a gentle scaling. The residuals indicated minor but sufficient deviations.



SIGNIFICANCE

This project can provide insight into the structure and principles of planetary systems outside of the Solar System. By exploring the trends between mass, radius, and period, we can improve our understanding of planetary formation. Data cleaning, model fitting, and residual analysis are also important for astrophysics as learning to utilize them for noisy data is important for creating conclusions about our universe.



THANK YOU