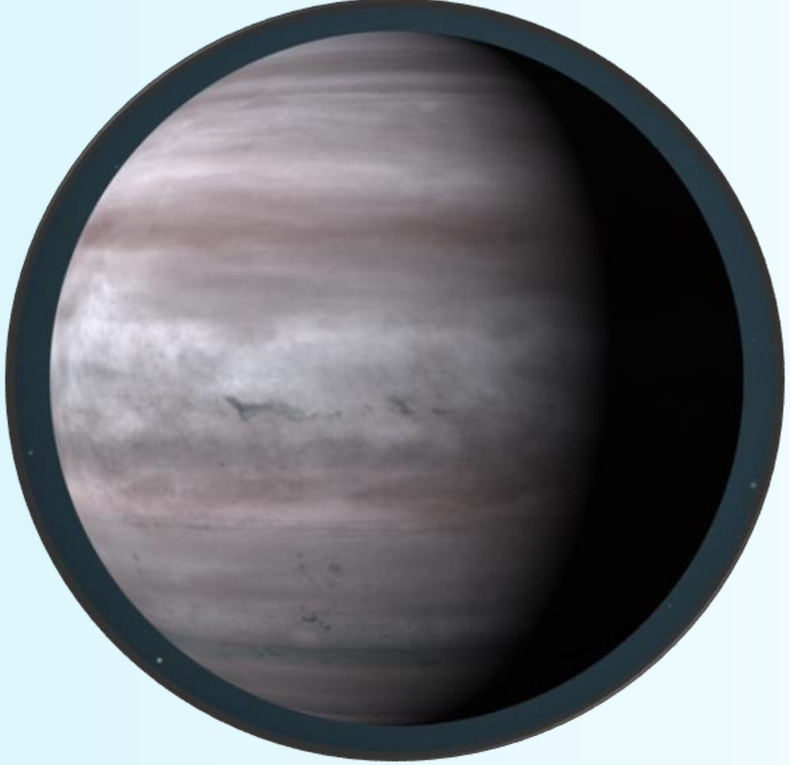

Measuring Planet Mass, Radius, & Density

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Group 4

Motivation

- Understanding a planet’s mass, radius, and density can tell us about
  - Composition
  - Evolution
  - Habitability

- By calculating these values for exoplanets, we contribute to improving models of planetary systems, improve our understanding of planetary formation, and assess the habitability of exoplanets.

Methods

1. Radial Velocity – Determining Mass

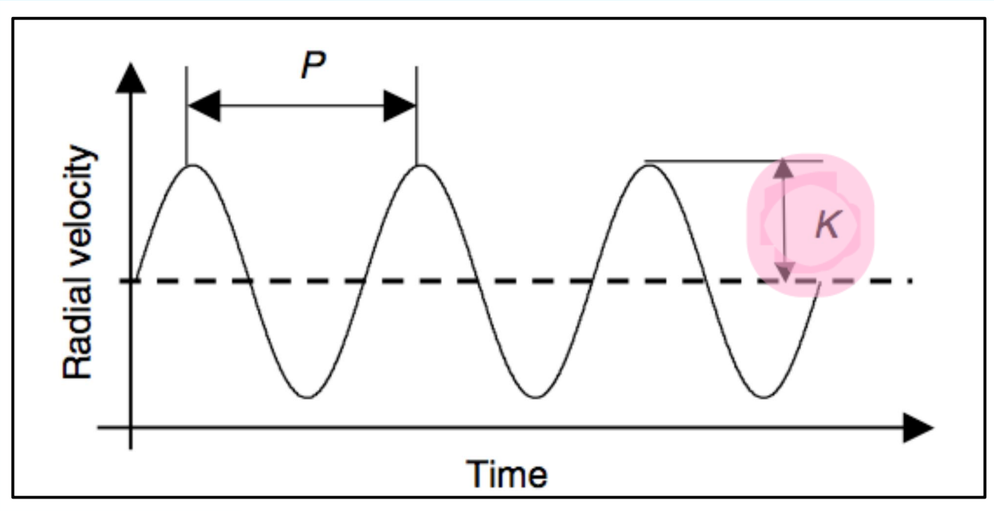


Image from Caltech

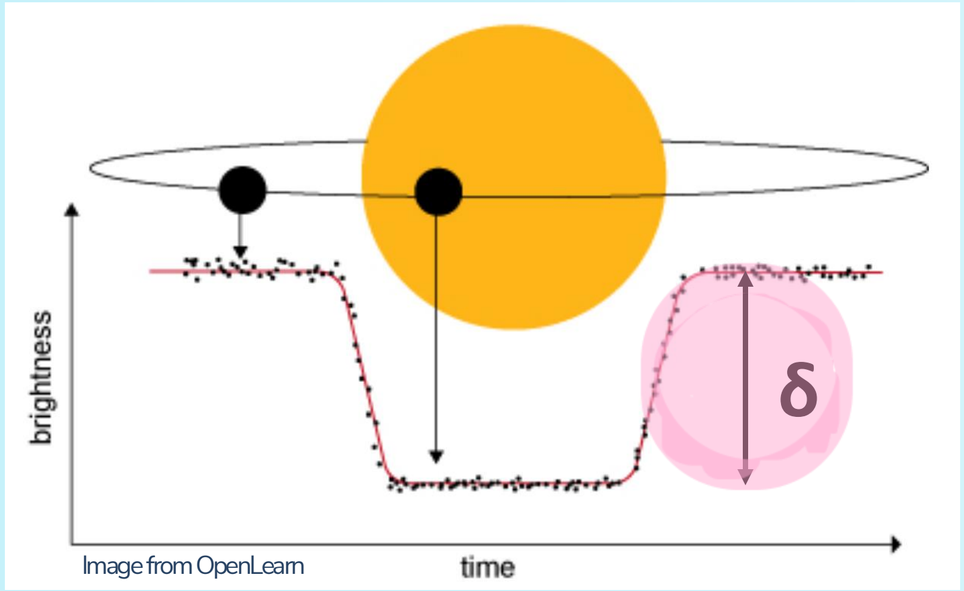
- Use RV data to extract semi-amplitude, K

$$K = \frac{Mp}{M*}\sqrt{\frac{GM*}{a}}\sin i$$

- Assume inclination angle to be 90°
- Use RV equation to solve for planetary mass, M_p

Methods

2. Transit – Determining Radius



- Use transit data to extract transit depth, δ

$$\delta = \left(\frac{R_p}{R*}\right)^2$$

- Use transit equation to solve for planetary radius, R_p

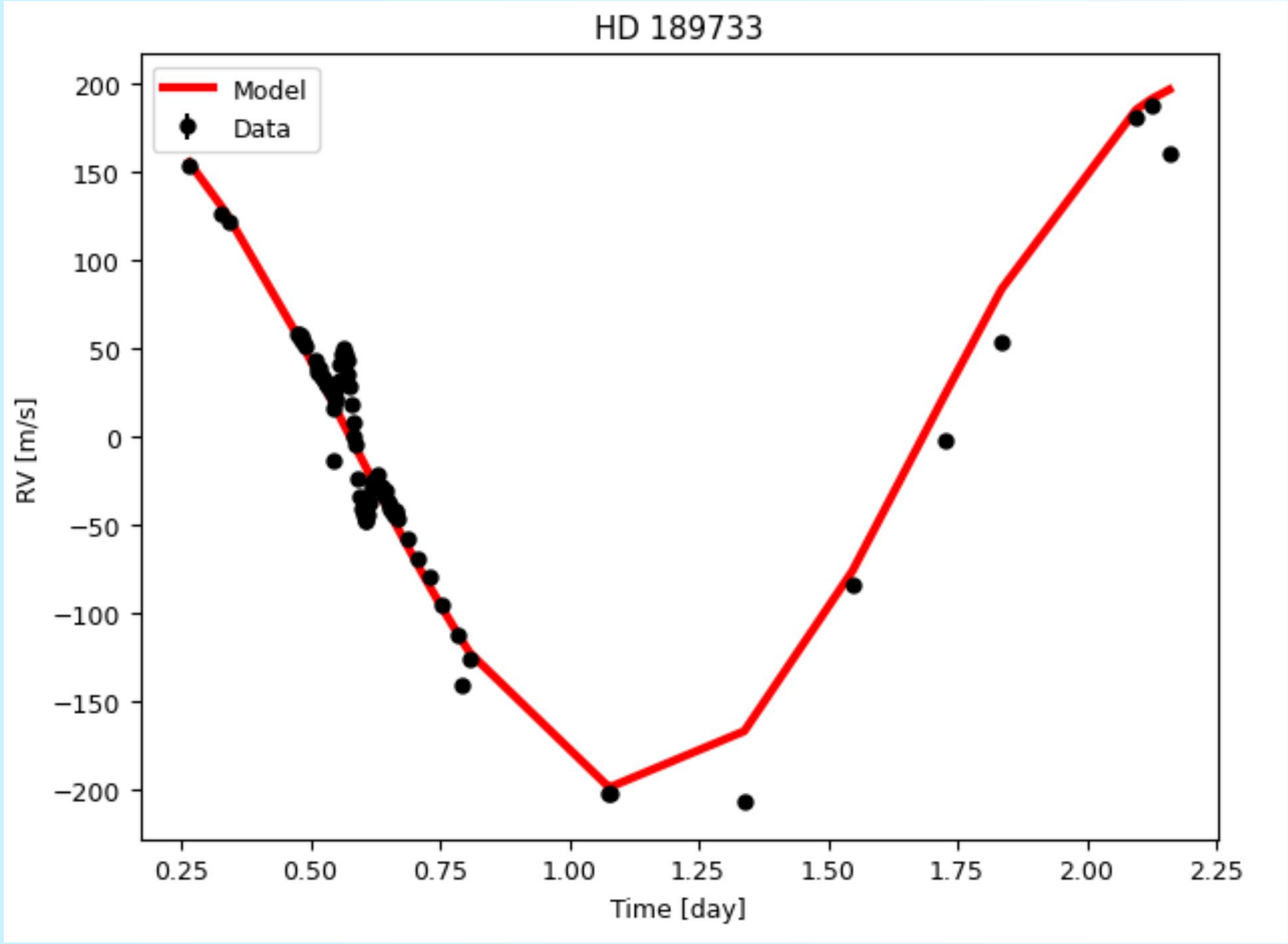
Methods

- Density is then calculated using mass and radius

$$\rho = \frac{Mp}{V} = \frac{Mp}{\frac{4}{3}\pi {R_p}^3}$$

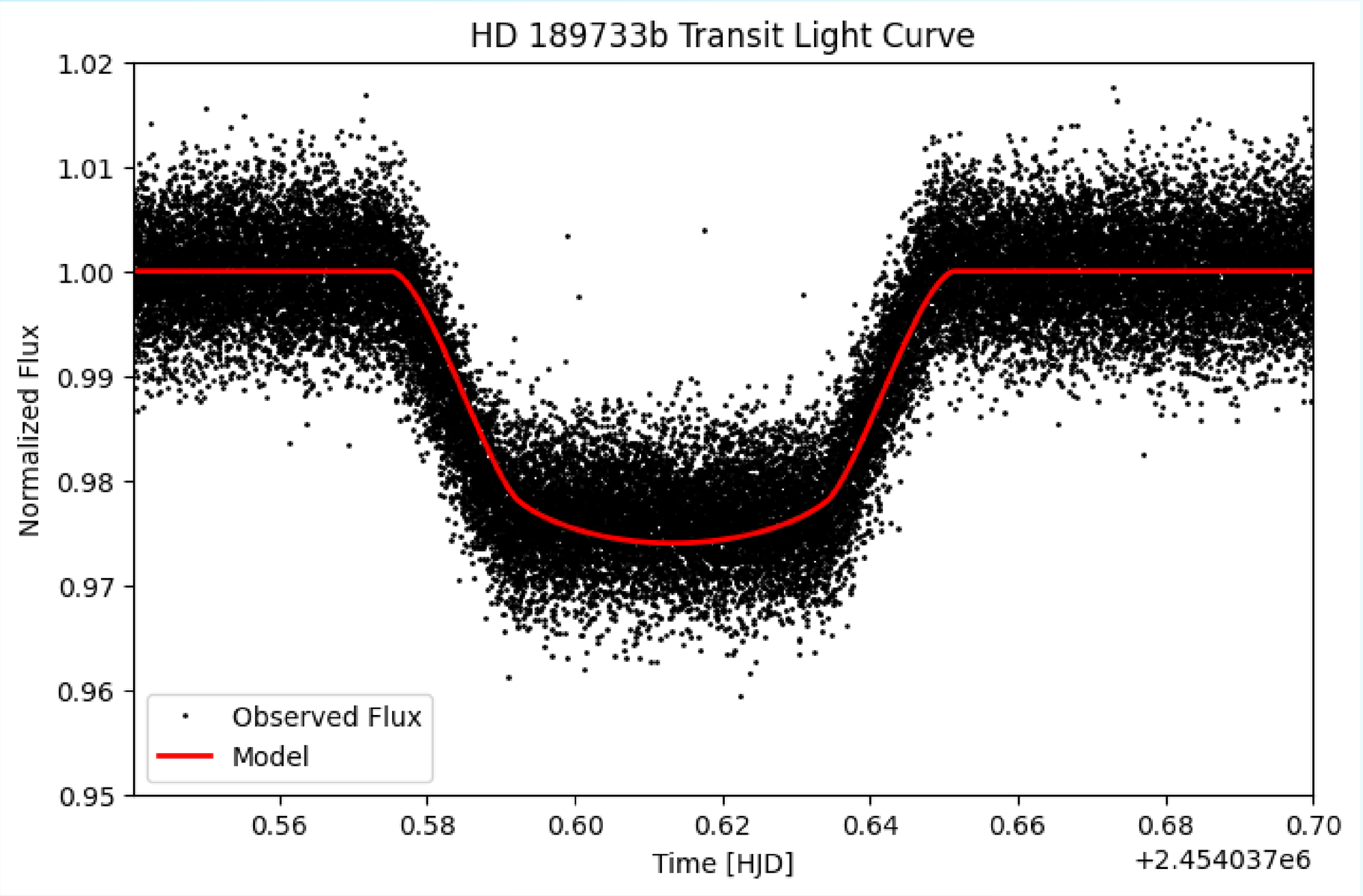
- Data retrieved from the NASA Exoplanet Archive, and for this project we focused on the exoplanet HD 189733b

Results



$M_p = 1.2914 \pm 0.0058\ M_J$

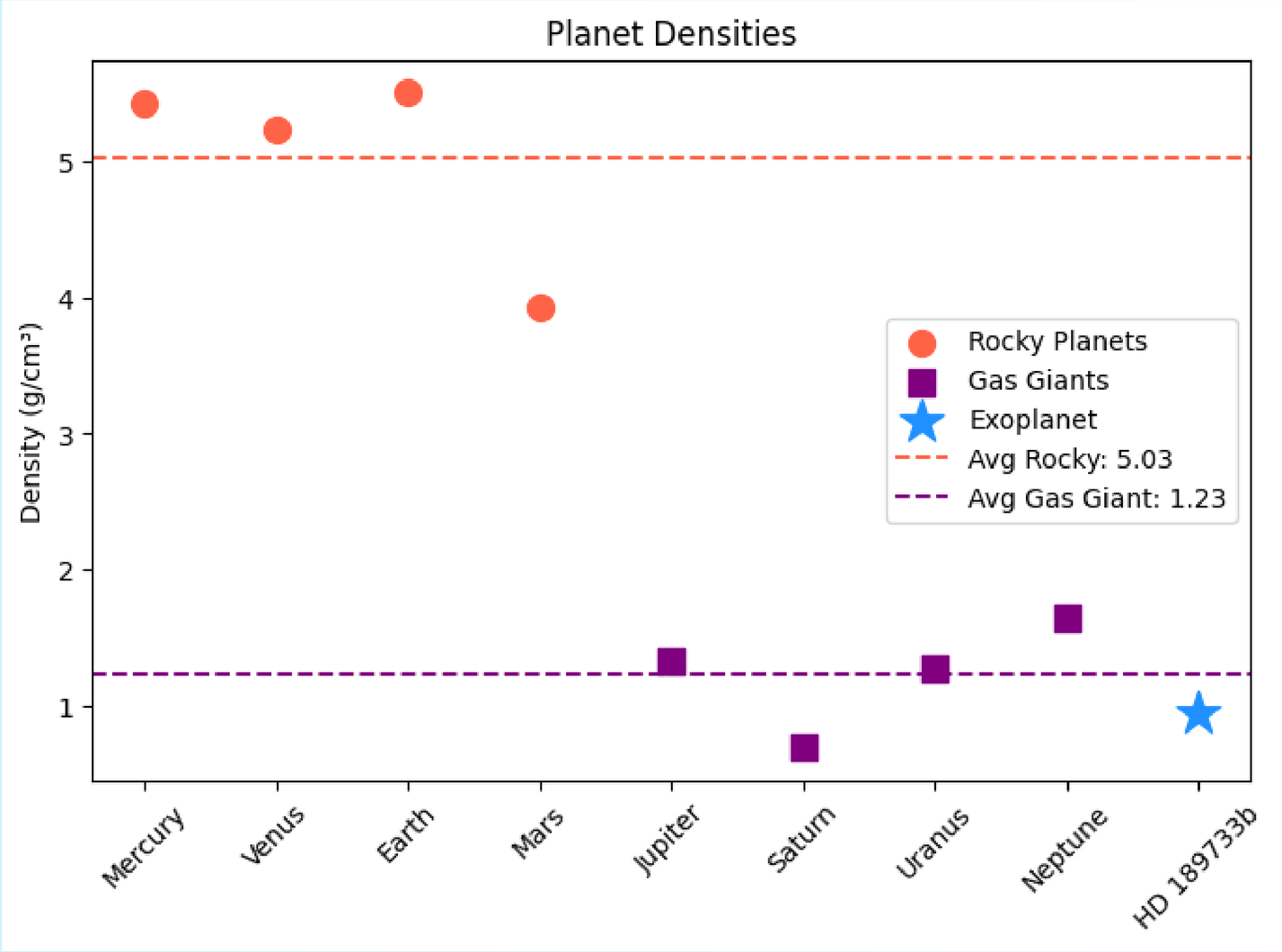
Results



$R_p = 1.3303 \pm 0.1625\ R_J$

Conclusion

- The determined density suggests that HD 189733 is a **gas giant**.



$$\rho = 0.681 \pm 0.249 \, {}^{g}/_{cm^3}$$